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SHELTERBELTS

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INTRODUCTION.

In a review of theoretical and practical work on the matter of shelter provided by the growing of trees, the most striking facts, so far as the United Kingdom is concerned, are the small amount which has been done in recent years, and the immense debt owed to past generations of tree planters and woodland protectors. Whatever the shortcomings of our forefathers in the matter of the supply of merchantable timber, 'the English Scene' to-day is the result of their wisdom, and much of that picture is due to the provision of tree shelter for one reason or another. Much of that shelter has outlived its usefulness, and frequently all that remains are lines of old trees, often widely spaced and much branched, which are of more aesthetic than practical value. The removal of a large amount of this hedgerow woodland, as a result of two wars in one generation, has awakened a consciousness of its value as protection for land and people from extremes of climate. Upland areas have also felt the change; the increasing use of conifers led to the planting of forest on such areas where they served as windbreaks; now many of these, both mature and in middle age, have been sacrificed, and, although afforestation on a large scale has been undertaken in the past twenty-five years, large uniform blocks of coniferous forest do not replace well distributed and strategically placed shelterbelts. We now find ourselves, in Britain, in much the same position as those newer countries which came to realize the value of shelterbelts through their absence, or inefficiency owing to bad management. In new countries it has been recognized that shelter, from either the windbreak, shelterbelt or farm woodlot, is ancillary to programmes of afforestation, soil conservation and anti-erosion works. In many British colonies, where an expanding agriculture, with the development of cash crops, depends on a fine balance of nature and climatic conditions, the necessity of shelter has made itself apparent. It is, however, in the countries which have faced the problems of settlement, or re-settlement, of peoples, that most of the work has been done in the last fifty years, although it is true that much repair work has been carried out in European countries.

There is already a considerable body of literature on the subject, proceeding from the scientific, through the practical, to the popular. The problems which have given rise to different investigations have ranged from national ones to purely local ones concerned with the protection of some particular crop or stock, or the prevention of deterioration or movement of soil in varying degrees. Large-scale investigations have recently been carried out in the U.S.A. and U.S.S.R., and it is to the workers in those countries that it is most profitable to turn for information. Faced with varied and complex problems of settlement, crop improvement, and soil conservation, they have, of necessity, been led to investigate and review the work already done in other countries, and make deductions from its successes and failures, before embarking on new projects.

Countries in which work comparable in scale, system, objectives and conditions has been done are the United States, Australia, and Russia and parts of Africa; in Russia, Government action began in the nineties of last century and has been carried on, with interruptions, ever since. Elsewhere, only after the twenties of this century is there evidence of serious study of the subject. Some countries [3, 10], including Great Britain, have covered in some degree of intensity the more practical work on the value of shelter. Canada [44] and New Zealand [58] have contributed valuable data and brought practical experience to the problems, while East Africa [56] and Ceylon have worked on similar lines. It should be noted that the intensity of investigation has in most cases been derived from a national urge and realization of the loss through neglect of, and the value of attention to, tree shelter. The outstanding fact, in reviewing the work done so far, is the necessity of investigations being based on scientific principles, with recognized experimental stations and demonstration areas under skilled observers. This fact is the more easily appreciated when the items of connected research are enumerated. They include wind velocity, temperature, precipitation, water retention, soil moisture, snow accumulation, humidity and evaporation, soil movement and soil building, which all affect agricultural yields, both of crops and stock, as well as living conditions; the possibility of the effects of shelterbelts being felt in adjacent forest areas, to the benefit of the forest crops, must not be forgotten. Crop increases are often spectacular when the necessary shelter is provided [36], and shelter may be a matter of life and death to stock [2, 44, 48] in early life and at shearing, or when put to pasture where loss of condition due to exposure means less resistance to disease. To the human population lack of shelter leads, through poorer crop yields, to crops of low food value and malnutrition of the people. Moreover, these primary results should not obscure the economic and material benefits which accrue to the community from shelterbelts through the provision of fencing and building material, fuel, live fences and boundaries, fodder, and breeding places for game and useful birds.

TYPES AND STRUCTURE OF SHELTERBELTS.

The question of suitable types of shelter for varying conditions and the proper selection of species, has been studied in many countries, notably U.S.A., Russia, Austria, Italy, Denmark and Great Britain. As the result of the World Forestry Congress in 1926, The International Institute of Agriculture caused an enquiry to be made into damage by wind to crops, forest, and farm animals. This investigation [3, 4] provided conclusions under a

SHELTERBELTS

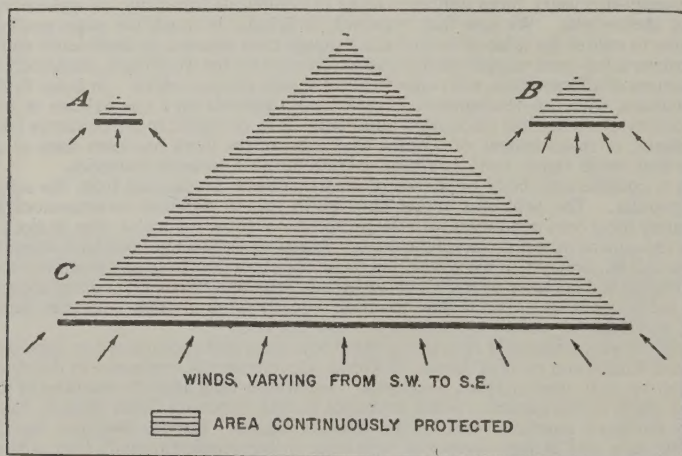
number of headings on the evidence then available (1927), and was followed by the publication of a monograph [5] (1933) which provided more detailed elaboration of the special points of interest in most countries of the world. The earlier report gave brief findings on such points as:—(1) types of shelterbelt or screen, (2) bushes with trees, (3) density, (4) arrangement, (5) method of management and thinning, and (6) fire protection: it also included a list of plants suitable for use in various countries. The evidence that had been collected by that date (1927) showed that the protection afforded took effect, on an average, over an area 15–20 times the height of the trees, but might be reduced under certain circumstances (Figs. 1, 2). The main factor appeared to be height, the function of which, when used to express the extent of the protected areas, has led to puzzling discrepancies. Investigations made at Mariupol (U.S.S.R.) resulted in the use of a formula of $2\frac{1}{2}$ times the square of the height, but investigators elsewhere have given widely differing figures, the penetrability of the shelter being one of the factors to be taken into consideration. There are other examples of diversity of views, such differences being only in the matter of degree but worth recording. In general, it may be said that belts of high trees protect a farm against the worst prevailing winds [53]; a series of low, dense hedges provide shelter for individual fields; and a properly designed shelterbelt, 66 ft. high, will give full protection for about 330 ft. and partial protection for nearly 1,000 ft.

The species used will vary, country by country, but three main types can form the bases for any modifications:—

- (1) The tree type—with one or more storeys of tree species.
- (2) The shrub type—in which the second storey is of shrub species.
- (3) The mixed type—in which the lower storeys are composed of slower growing tree and shrubs.

FIGURE 1—A windbreak must have great length to protect effectively any considerable field area.

This diagram covers only such conditions as might reasonably occur in the summer with the wind in a general southerly position, but shifting from S.W. to S.E. Only a triangular area on the north (A, B) is then so protected that crop benefits can reasonably be expected. Until this triangle reaches out to 12 times the height of the belt (C) the possibilities of distance protection are not being utilized. From [9].



The use of openings or wind 'chimneys' is also a possibility, in order to break up wind currents, and on this point Russian investigators [7] have classified shelterbelts into three main classes based on wind currents in their neighbourhood:—

- (1) Shelterbelts impenetrable to wind throughout their height.
- (2) Shelterbelts, slightly penetrable below, and impenetrable above.
- (3) Shelterbelts, partly penetrable to wind throughout their height.

It is to be noted that the Russians tend to favour the penetrable types. This is understandable when it is realized that the principal problems of the steppe country are to break up wind currents and aid snow distribution, and that the experiments are apparently more concerned with crops than with stock. Other information comes from American workers [8] dealing with the effective length of windbreaks (Fig. 1), the zone of protection (Fig. 2) and amount of shade cast, and the spread of roots to neighbouring plots of land. In New Zealand the application and development of techniques in shelterbelt management [58] have been fully dealt with under conditions showing similarity to parts of Europe, and this is a valuable contribution for the practical farmer to study.

In Ceylon it is the practice to leave belts of jungle as windbreaks when clearing land for tea planting, which raises the possibility that much could be done in Africa, and elsewhere, by leaving belts of natural forest when clearing land for farming. This plan has been outlined in Sierra Leone forest departmental reports. In Nigeria, the planting of belts of quick-growing exotics for the same purpose has been reported, but more recently the practice has been to make use of indigenous species, though results may be slower. Much can be hoped for from native tree and shrub communities.

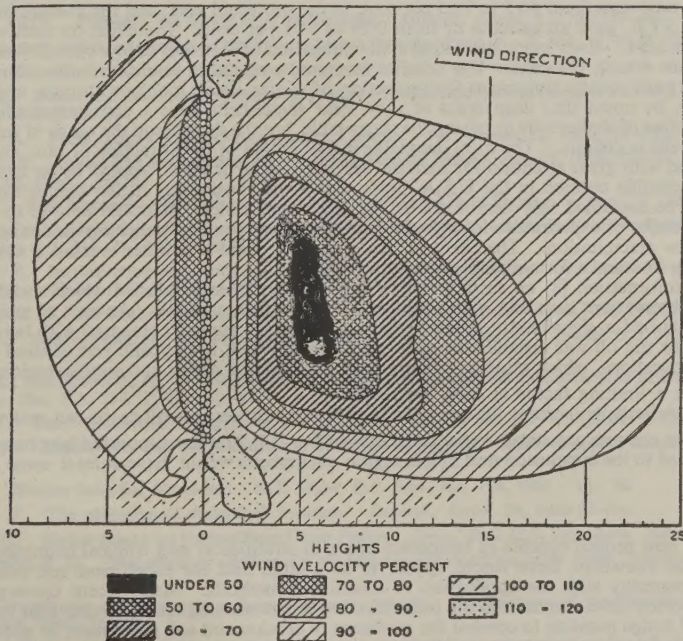
SHELTERBELTS

The efficiency of shelterbelts appears to depend largely on the configuration of the country and the strategic arrangement of the belts, which possibly restricts the value of some of the Russian findings to closely similar steppe conditions. There are, however, basic principles in the arrangement. The primary system of shelterbelt should be established along the edges of gullies, streams, ravines and permanent roads, the secondary system being along the borders of permanent fields, supplemented by a geometrically arranged network. The main belts should be set at right angles to the most destructive winds. Waste land should, wherever possible, be planted. On agricultural lands, from 5 to 8 per cent. of the total area is involved. Distances between shelterbelts, under Russian conditions, are given as 3,280 ft. and 1,640 ft. in the northern and drier southern regions respectively. Minima for width of strip are 50 ft. for main belts, and 23 ft. for lateral ones. In America [1] the typical field shelterbelt is described as being a strip 8 rods (132 ft.) wide, while spacing of trees will vary from 4 ft. to 6 ft. in rows 8 ft. to 10 ft. apart. For Britain [23] it is recommended that belts should be at least 165 ft. to 200 ft. wide in order to provide some poles and other useful material.

SILVICULTURE.

Planting density must vary with moisture, soil and species, but the consensus of opinion favours dense planting, 3-4,000 plants per acre, half of which should be of shrub species. It is suggested that, to facilitate the use of machines in weeding and cultivating, the distance between plants in the rows should be not more than 1 ft. 6 in. to 2 ft. 6 in., and the distance between rows 4 ft. to 4 ft. 6 in. First thinnings, as early as the 6th year, are restricted to the shrubs or understorey, to encourage sprouting, and this may be repeated. From the 15th year onward the selective removal of secondary tree species is undertaken, favouring the principal species. Thus a regular system of storeys is produced in the belt.

FIGURE 2—The actual field of protection of a windbreak 19 heights long, with an average density of 50 per cent but more open in the lower than in the upper half. The air pushes through the opening at the bottom and shoots upward on the leeward side. The wind was measured 16 inches above ground. From [9].



It is apparent that good silviculture must be the basis of the construction and maintenance of efficient shelterbelts. The technique and importance of thinning, and suggestions for regeneration, have been comprehensively dealt with by various workers [1].

Good floor conditions are essential to the survival of shelterbelts. An example [56], quoted from East Africa, illustrates this principle of silviculture. Protection against animals and game must be secured by fencing, and fire protection carried out. For the control of insect pests, useful birds should be encouraged by the selection of suitable tree and shrub species in the scheme.

SHELTERBELTS

With reference to the selection of species, it is worthy of note that the Russians place a high degree of reliance on native species, and this view seems to find favour also in America, while in East Africa indigenous species are likewise suggested as more suitable for permanent belts. Early German workers in Europe found that belts of pure conifers suffered from serious insect attack.

One authority [23] suggests that the species which possesses most of the requirements of the ideal shelterbelt tree for the hill country of Britain is Sitka Spruce (*Picea sitchensis*). Dry sites facing south, up to 1,000 ft., should be planted with Scots Pine (*Pinus sylvestris*). On chalk or limestone, the Austrian Pine (*P. nigra*) makes good shelter. Beech can also be used, but when used on downland it is advisable to mix it with Scots Pine. Generally speaking, suitable mixture of species is favoured in most countries.

RESULTS OF EXPERIMENTS.

Investigators in different countries have used differing methods, but their objects have been, in the main, in line with those of the River Don project [1]:—

- (1) Protection of farms from wind.
- (2) Aid in ripening grain crops.
- (3) Reduction of evaporation.
- (4) Retention of snow.
- (5) Rise in the water table.
- (6) Decrease in the range of temperature fluctuation.
- (7) Attraction of rain.
- (8) Increase in the productivity of unused waste lands.
- (9) Control of soil erosion.

There is general agreement that favourable results are possible in protection of farms from wind, and in aiding the ripening of grain. With regard to reduction of evaporation, this has been successfully demonstrated. In Russia, evaporation was found to be 44 per cent. greater in the open than in a shelterbelt zone. The precipitation/evaporation ratio rose from 46.5 to 76.5 per cent. in the protected area, and the average moisture content of the soil down to 3.3 ft. gave an increase of from 0.79 to 1.75 per cent. The effect on relative humidity varied from 0.5 to 4.5 per cent. Even more interesting is the mitigation of extremes of low humidity showing favourable differences of from 4 to 8 per cent. The benefits from snow retention and distribution compared with open frozen-out country are equally important for protection of winter wheat, moisture storage, and increased yields. It must, however, be noted that deep drifts of snow near shelterbelts have a detrimental effect. No data are available on the effect of shelterbelts in raising the water table, but the decrease in the range of temperature fluctuations within the belts is definite. The most debatable matter is that of the attraction of rain, and the experiments have been watched with great attention for material results. So far it would appear better to leave the question open, although scientific opinion in the U.S.A. holds that if the consistently higher figures for shelterbelt areas cannot otherwise be explained they denote a trend of great significance. It would be well to keep in mind the very favourable results of experiments in India [57] on the use of contour trenching, in conjunction with forest growth, to increase precipitation. The effect of tree growth on wind and water erosion is already well known, while soil building by humus formation is an acknowledged fact.

Some Russian information [8] on surface run-off has recently been published which should stimulate work elsewhere. The observations have been going on since 1892, with interruptions. An area of which 6 per cent. was bearing shelterbelts had a significantly lower coefficient of surface run-off compared with bare steppe (0.362 as against 0.544) while run-off was insignificant on a third area of which 18 per cent. was covered with shelterbelts.

There are two questions, which must be of importance in parts of Africa and similar regions, namely:—

- (1) Is moisture a limiting factor in crop production?
- (2) If so, can shelterbelts increase the available moisture, or conserve it till crops can make use of it?

For East Africa the answers are stated to be in the affirmative [56], and are supported by observations and other data, which have led to the conclusion that in this region shelterbelts would have at least some of the advantages noted elsewhere.

CONCLUSIONS.

Apart from the now proved benefits in temperate areas, in subtropical and tropical countries, both within the British Empire and elsewhere, there would appear to be a large field for experiment and collection of further information, concurrently with the application of established methods. Many recent Government reports on agriculture and forestry have emphasized the importance of reconditioning areas of land, thus indicating the need for shelterbelt and hedge planting to combat the problems of erosion and soil movement, in addition to amelioration of climatic conditions and limiting the effect of desiccating winds. In Britain it may be some years before the full effect of the removal of so much shelter by war fellings is realized, but the matter is none the less deserving of serious attention. The work already done leaves no doubt that the shelterbelt is the meeting ground of the departments interested in soil conservation and rural economy and that further primary experiment to prove this is now unnecessary: observations of wind velocity, humidity, evaporation, soil moisture, soil fertility, and even precipitation, point with remarkable accord to the practical ameliorative value of shelterbelts.

SHELTERBELTS

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ABSTRACT SECTION

NOTE.—A capital letter in square brackets following the reference denotes the language in which the paper is written. A small letter denotes a summary in another or the same language, e.g. [G.e.]—German, with English summary. English [E.] is only indicated for papers published in journals usually written in foreign languages. The term "billion" used in papers originating in North America means a thousand million.

0. GENERAL FORESTRY

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07. EDUCATION AND RESEARCH. INSTRUMENTS AND TOOLS

07.2 (497). SCHIMITSCHEK, E. Die deutsche Leistung auf dem Gebiete der Erforschung der forstwissenschaftlichen Grundlagen des Südostraumes. [German accomplishments in the realm of forestry research in southeastern Europe.] *Cbl. ges. Forstw.* 68, 1942 (203-14). [G.]

A brief review of the most important contributions made by German research workers on forestry and related subjects (forest entomology, botany, geology, etc.) as applicable to southeastern Europe. The bibliography contains 56 references to works by scientific writers mentioned in the text.

07.2 (54) : 01.4 : 2. [Methods of experimental research.] Report of the Committee. With appendix. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 3, 1944.* (61-4).

07.2 (54) : 01.4 : 2. SANT RAM, B. [Methods of experimental research.] Design and analysis of forest experiments. With appendices and report of debate. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 3, 1941* (65-95, 95-102).

A special committee considered amendments and additions to be made to the Experimental Manual (H. G. Champion, 1931), which is the official textbook on forest research technique for India. The chief alterations comprise:—(a) rewriting the chapter on statistical methods to include recent developments and improvements in methods of statistical analysis, combining with it the data on experimental design and layouts on the lines indicated in B. Sant Ram's paper, which includes completed examples of the analysis of typical forest experiments; (b) revision of the layout of natural regeneration experiments and the methods of assessment of natural regeneration; (c) incorporation of recent experience in regeneration by coppice; (d) amplification of subject matter on soil, inheritance of characters, mixture of species, methods of bamboo management, afforestation work, pruning, frost, erosion and landslips, and reclassification of data on artificial regeneration; (e) addition of new matter on fodder and grazing, preservative plots, root competition, gum and resin tapping, ecological experiments, and glossaries of ecological and silvicultural terms. Pending the publication of the revised manual the above references should be consulted for details.

07.7 : 44.3. CLAPPER, R. B. Improved cork-borer method for inoculating trees. *Phytopathology* 34, 1944 (761-2). [U.S. Bureau of Plant Industry.]

The writer describes an improved instrument which he has designed to eliminate one of the movements normally required when using the cork-borer method of inoculating trees.

09.1. Forest History

09.1 : 12.25 (43.1-5). KÜNZANZ, H. Zur Geschichte des Nadelholzanbaus in Oberhessen. [The history of conifer cultivation in Oberhessen.] *Allg. Forst- u. Jagdztg.* 119, 1943 (15-21). [G.]

09.1 (494). HESS, E. Zur Geschichte des Waldes im Oberhasli (Berner Oberland). [The history of forests in Oberhasli (Bernese Oberland).] *Veröffentl. geobot. Inst. Rübel, Zurich* No. 16, 1940. pp. 136 + plate.

09.2. Pre-history

09.2 : 12.26-8 : 12.14.5. HARRIS, T. M. On the taxonomic value of the anatomical structure of the vegetative organs of the Dicotyledons. 4. Fossil plants. *Proc. Linn. Soc. Lond., 1942-43*, 155th Session, Part 3, 1944 (221-2). O.B.D.

In the taxonomy of fossil plants, fine anatomy is used for two purposes: (1) to recognize species or to discriminate between them; and (2) to recognize larger groups such as genera, families or orders. In the identification of species, often from isolated leaves or fragments of leaves, cuticle structure (which reflects epidermal structure) and gross form are of great importance when used in combination, since unrelated species showing similar gross form generally have an entirely different type of leaf cuticle. Examples are given of the value of cuticular or epidermal features in distinguishing also between larger groups of plants. It is recognized, however, that there are limitations to the use of such features for diagnostic purposes.

09.4. Forest Statistics

09.4 (410) : 98.2. GREAT BRITAIN. Board of Trade, Statistics Department: Fifth census of production, 1935. Part IV: Section I. Final report on the building and contracting trade, clay and building materials trades, timber trades. H.M. Stationery Office, London. 1944. pp. 167.

In the timber trades section of this publication (pp. 96-167) statistics for the United Kingdom are given on the number, output, personnel, trade, etc., of wood-working and wood-using enterprises.

09.4 (485) : 61 : 65 : 98.1. Riksskogstaxeringens resultat för Västerbotten och Norrbotten. [Results of the state forest survey of West Bothnia and North Bothnia.] *Skogen* 31, 1944 (128-31; 144-5). [Sw.]

For the Province of West Bothnia and the coastal area of North Bothnia the normal survey procedure was followed [cf. *For. Abstr.* 5 (156)], while for the Lapp territory of North Bothnia the survey data available for both crown and private forests were used. Most of the field work was done in 1941; the previous survey was made in the years 1925-26.

Results of the survey showed that little change had taken place in the forest area of West Bothnia and the coastal region of North Bothnia. There was some increase in the area of pure Pine forests in the coastal area and of the broadleaved forest in the whole region surveyed, while the extent of Spruce forest showed a slight decrease in all three regions surveyed, a condition contrary to that observed in Jämtland and Västernorrland. In the Lapp territory of North Bothnia the area of forested land decreased appreciably between the two surveys; this is explained by the fact that the survey of 1926 extended considerably higher towards the fjelds than did the later survey.

R. P. J.

09.4 (71) : 98.1. CANADA. Estimate of forest production: operations in the woods in Canada, 1942. Dominion Bureau of Statistics, Ottawa. 1944. pp. 10. [E.F.]

The estimated or reported total production of each of the principal wood products is tabulated together with its equivalent in volume of standing timber and its value. Forest production in terms of standing timber and value is recorded for each province, and figures are given for the value of each of the principal forest products for 1942 and the preceding four years. The total forest production in 1942 is estimated at over 3 billion cu. ft. of standing timber with a value of more than \$234 million.

09.4 (71.4) : 98.1 : 94. Avenir de la forêt québécoise. [Future of the forest of Quebec.] Association des Ingénieurs Forestiers de la Province de Québec. 1943. pp. 53 + map. [F.]

Data are given on the forests (including forest ownership) and timber production in Quebec. Statistics on forest areas, growing stock, and increment are presented separately for the ten economic regions into which the Province is divided for the purpose of this publication.

09.4 (77.1) : 09.7 : 97. Ohio's forest resources. Progress report based on a survey conducted during 1939-1943 and a presentation of a recommended long-range forestry program for Ohio. *For. Publ. Ohio agric. Exp. Sta.* No. 76, 1944. pp. vi + 109.

09.4 (79.5 : 79.7) : 98.1-2 : 12.25. COWLIN, R. W., BRIEGLEB, P. A., and MORAVETS, F. L. Forest resources of the Ponderosa Pine region of Washington and Oregon. *Misc. Publ. U.S. Dep. Agric.* No. 490, 1942. pp. iv + 99 + maps.

This report is based on the findings of the U.S. forest survey in the Ponderosa Pine region of Washington and Oregon. The forest area of the region is over 22 million acres or about one-third of the land area. A total of 13.4 million acres support stands of saw-timber size, of which 78 per cent. are Ponderosa Pine forests. Second-growth conifers occupy 3.7 million acres.

The region has a total saw-timber stand of 127.1 billion bd. ft., of which 64 per cent. is Ponderosa Pine, 15 per cent. Douglas Fir, and 5 per cent. each of Western Larch and White Fir. Annual gross drain on saw-timber stands is given as 2.6 billion bd. ft., about half of which is removed by cutting and the remainder destroyed by insects, fire, wind and disease. The current annual gross increment is about 1.1 billion bd. ft., but it is believed that much of this is offset by damage in mature and immature stands, and annual net growth is estimated at 219 million bd. ft.

09.4 (79.5 : 79.7) : 98.1. MORAVETS, F. L. Oregon-Washington timber inventory. *Timberman* 45 (10), 1943-44 (58, 60, 62).

The estimated saw-timber volumes as for January 1943 on unreserved lands in Oregon and Washington are tabulated by species and county.

09.7. Monographs of Individual Forest Regions

09.7 (43.1-5) : 09.1. SCHMUZIGER, H. Forstliche Besonderheiten des Rheintals, bedingt durch die historische Ereignisse. [Forest peculiarities of the Rheintal forest district conditioned by historical events.] *Schweiz. Z. Forstw.* 95, 1944 (129-42). [G.]

GENERAL FORESTRY

09.7 (47.2-6) : 60.31. KRUEDENER, A. VON. Russlands Waldungen und Waldwirtschaft bis zur Bolschewistenherrschaft in Oktober 1917. [Russia's woodlands and forest management up to the Bolshevik rule in October 1917.] *Forstarchiv* 19, 1943 (120-33). [G.]

09.7 (485) : 12.19.2. BROMÉE, F. Der regionale Aufbau des schwedischen Waldes. [The regional structure of Swedish woodlands.] *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 5, 1943 (145-66). [G.]

A general discussion on the forest regions and forest types of Sweden.

09.7 (494). TANNER, H. Die forstlichen Verhältnisse im Kanton St. Gallen. [The forest conditions in the Canton of St. Gallen.] *Schweiz. Z. Forstw.* 95, 1944 (193-232 + plate). [G.]

The subject is dealt with under the headings: history of the canton, geology and soil, climate, tree species, forest legislation, forest administration, forest areas and ownership, working plans, forest management, forest utilization and revenue, timber sales, forest reserve funds, and employment in forestry.

09.7 (67) : 12.19. BROWN, E. A tropical African forest. *J.R. hort. Soc.* 69, 1944 (274-6). O.B.D.

09.7 (68.4) : 12.19 : 12.26-8 : 57.0 : 64 : 43.3 : 46. RYCKROFT, H. B. The Karkloof Forest, Natal. *J.S. Afr. For. Ass.* No. 11, 1944 (14-25 + plates).

The Karkloof Forest, probably the largest remnant of indigenous forest in Natal, has an area of 15,000 to 20,000 acres. The author gives a general survey of the site and discusses successional trends, the structure and composition of the forest and evidence of forest destruction by fire, over-exploitation and conversion to cultivated land.

Real Yellowwood (*Podocarpus latifolius*) remains the dominant species in most of the unexploited parts of the forest. The chief associated species are *Celtis kraussiana*, *Xymalos monospora*, *Podocarpus falcatus*, *Calodendrum capense*, and *Kiggelaria africana*.

09.7 (71.2) : 12.19 : 12.25-8 : 09.4 : 98.1. HOLMAN, H. L. Forest resources of the southern Yukon. North Pacific Planning Project, Canadian Section. 1944. pp. 16 + folding map.

The North Pacific Planning Project, which is sponsored by the Joint Economic Committee of Canada and the United States, is concerned with a systematic study of the economic possibilities of the North Pacific area, including certain portions of British Columbia and Alberta, the whole of Alaska, the Yukon and the Mackenzie District of the Northwest Territories. During the summer of 1943 a number of parties were in the field collecting information on the natural resources of the area. The present report gives the results of a preliminary reconnaissance survey undertaken to obtain information on the distribution, composition, and general condition of the forests of the southern Yukon. Much of the information obtained in the survey is incorporated in a forest cover map.

The report includes notes on the methods of survey, distribution of tree species, the forest types and stands on the principal watersheds and valleys, the forest reserve and the possibilities of its commercial exploitation. The region dealt with covers an area of approximately 111,637 sq. miles, of which 16 per cent. is considered to be normally growing forest, 35.4 per cent. unproductive forest, and 48.6 per cent. water, tundra or barren. It is estimated that there are about 1,370,300 acres of merchantable timber in the Territory bearing a total stand of 8.9 billion bd. ft., of which at least 90 per cent. is White Spruce (*Picea glauca*). The annual yield of merchantable timber is estimated at 144 million bd. ft., of which little could be logged economically under present conditions. Tree species other than White Spruce found in this area include Black Spruce (*P. mariana*), Lodgepole Pine (*Pinus contorta* var. *murrayana*), Eastern Larch (*Larix laricina*), Balsam Poplar (*Populus balsamifera*), Aspen (*P. tremuloides*) and White Birch (*Betula alaskana*).

09.7 (71.4). ROY, G. Aperçu du problème forestier dans les Comtés du Bas St-Laurent et de la Gaspésie. [On the forest problem in the Counties of Bas St-Laurent and Gaspé.] *For. québec.* 8, 1944 (65-81). [F.]

09.7 (728.6) : 98.1. BARBOUR, W. R. Forests of El General Valley, Costa Rica. *Trop. Woods* No. 79, 1944 (10-5). [U.S. Forest Service.]

El General Valley, an area some 80 miles long and averaging 25 miles wide, is situated between the cordillera and the coast range in southwestern Costa Rica. Most of the region is unexploited and bears a heavy stand of first-growth timber. Before the construction of the Pan American highway, this section of Costa Rica was very inaccessible and lumbering was confined to the extraction of materials for local use. A reliable estimate of the total amount of timber in the evergreen rain forests of El General Valley is not possible, but the writer believes that the area contains up to 10 billion bd. ft., mainly of species of present or potential commercial value. A list is given of thirty-three tree species seen by the writer in this area which attain a diameter of 24 in. and have a merchantable height of 32 ft. or more.

09.7 (729.6) : 12.19. GOODING, E. G. B. Turner's Hall Wood, Barbados. *Carib. For.* 5, 1944 (153-70). [E.e. span.] [Imperial College of Science and Technology, London.]

This wood covers some 50 acres and is the only remaining 'forested area' in Barbados. Its ecology and composition are discussed. It is not a true rain forest, despite the fact that temperature and rainfall are suitable for the development of such vegetation. This is probably due to the effect of strong winds in aggravating the dry-season conditions and to rapid run-off favoured by steep slopes. 'Tropical semi-deciduous forest', a term used in Trinidad, describes very well the forest type represented by this wood.

1. FUNDAMENTAL NATURAL LAWS OF THE FOREST

11.4. Soil

11.41. Soil Physics

11.41.2-3 : 11.62. HEINRICH, F. Zur Wirkung oberflächlicher Bodenverdichtung auf den Wasserhaushalt

sandiger diluvialer Waldböden. [On the effect of soil surface compaction on the water relations of sandy diluvial forest soils.] *Z. ges. Forstw.* 75 [69], 1943 (213-20). [G.g.]

The surface layers of two different soils of this type

were artificially compacted without producing a significant effect on the water content and aeration of the soils.

11.41.5-6 : 11.48.2 : 65.7 : 12.19.21-3. LETKOVSKIY, A. I. *Izmenenie vodopronitsaemosti peschanykh i supeschanykh pochv pod vliyaniem rubok lesa. [Changes in the permeability to water of sand soils and sandy soils under the influence of fellings.] Lesnoe Khozyaystvo No. 6, 1941 (11-7). [Russ.]*

A report on investigations in the Kirov region during the spring of 1938 in a *Pinetum hylocomiosum* on a sandy soil and in a *P. hypnosum* on a sand soil; the stands were of different ages, having densities of 0.7 and 0.4-0.6 respectively. The permeability to water as determined by infiltration tests tended to be greater (1) in the sand soil as compared with the sandy soil; (2) under the denser stands as compared with the more open ones (being almost as low in the latter as in clear-felled areas, which had the lowest permeability); (3) under the older stands as compared with the younger; (4) in soils without a ground cover as compared with those having such a cover—a grass cover lowered the permeability by anything up to 50 per cent., whereas a moss cover was much more favourable to the penetration of water.

11.41.5-6 : 91.3 : 22.89. SKORODUMOV, A. S. *Vliyanie lesnykh posadok na skorost' vpit'vaniya vody besstruktturnymi raspakhivavshimisya pochvami. [The influence of forest plantations on the speed of absorption of water by structureless ploughed soils.] Lesnoe Khozyaystvo No. 3, 1941 (7-14). [Russ.]*

Infiltration tests carried out in the Chernigov region indicate that land formerly cultivated and now carrying young plantations (up to 25 years old) absorbs water more slowly than does comparable land carrying field crops and subject to regular cultivation.

11.42. Soil Chemistry

11.42.3 : 56 : 12.25 : 11.47.13. SÜCHTING, H. *Untersuchungen über die Ernährungsverhältnisse des Waldes. IX. Einfluss der Reaktion und der Entsäuerung des Bodens durch Kalk bzw. Magnesia auf Wachstum und Nährstoffaufnahme der Lärche, Kiefer und Fichte. [Researches on the nutrient relationships of forest trees. IX. Influence of reaction and the neutralization of the soil by lime or magnesia on growth and nutrient uptake of Larch, Pine and Spruce.] Bodenkd. PflErnähr. 32, 1943 (365-75). [G.] [Univ. Göttingen.] S. & F. 7 (175).*

Pot experiments with Larch, Pine and Spruce in acid soils [pH (KCl) 3] showed that growth of all three increased progressively as the pH (KCl) was raised to 5 by adding either CaCO_3 or MgCO_3 . Above pH (KCl) 5-4-6 growth was retarded. As the carbonates of Mg and Ca were equally effective it is concluded that the effect is a neutralizing rather than a nutrient one. Uptake of K was suppressed by heavy doses of Ca or Mg; uptake of Mg was greatly increased by Mg fertilizing and reduced by Ca fertilizing; uptake of Ca was but little affected by Mg fertilizing. P uptake depended on the reaction, and was greatest at about pH (KCl) 5; it was almost completely inhibited at pH (KCl) 5-4-6, even when the pots were heavily treated with P_2O_5 . MgCO_3 and CaCO_3 had the same effect on P uptake.

11.43. Biology of Soil, including Mycorrhiza

11.43.1 : 11.47 : 23.26.4. RAYNER, M. C., and NEILSON-JONES, W. *Problems in tree nutrition: an account of*

researches concerned primarily with the mycorrhizal habit in relation to forestry and with some biological aspects of soil fertility. Faber and Faber, Ltd., 24, Russell Square, London. [1944.] pp. 184. Price 12s. 6d. net.

This book is for the most part a reprint of a series of papers describing the authors' work on the growth of young conifers on heath soils at Wareham, Dorset, and its relation to mycorrhizal development and to the biological factors of the soil. The papers which have been collected are:—

1. M. C. Rayner. Mycorrhiza in relation to forestry. I. Researches on the genus *Pinus*, with an account of experimental work in a selected area. *Forestry* 8, 1934 (96-125).
2. M. C. Rayner. Mycorrhizal associations in Scots Pine. *Forestry* 9, 1935 (154-5).
3. M. C. Rayner. The mycorrhizal habit in relation to forestry. II. Organic composts and the growth of young trees. *Forestry* 10, 1936 (1-22).
4. M. C. Rayner. The mycorrhizal habit in relation to forestry. III. Organic composts and the growth of young trees. *Forestry* 13, 1939 (19-35). [Cf. *For. Abstr.* 1 (129-30).]
5. M. C. Rayner and I. Levisohn. The mycorrhizal habit in relation to forestry. IV. Studies on mycorrhizal response in *Pinus* and other conifers. *Forestry* 15, 1941 (1-36). [Cf. *For. Abstr.* 4 (14).]
6. W. Neilson-Jones. Biological aspects of soil fertility. *J. agric. Sci.* 31, 1941 (379-411). [Cf. *For. Abstr.* 6 (139).]

No important changes have been made in the text except for the amalgamation of the first and second papers to form chapter I. To these six papers have been added a glossary of technical terms and an introductory chapter in which the general background of the work is outlined. These additions, together with the remarks on the dust cover, imply that the book is expected to interest a wide circle of those concerned with agricultural matters, including many well-informed laymen, and it is pointed out that the presentation is not unduly technical. The glossary should certainly help the non-biological reader, though there are several striking omissions, e.g. anaerobic, arbuscule and epinastic.

While many foresters are familiar in a general way with Rayner's work, it should be much more widely known, and, as in the case of the classic work of Wiedermann on the check of Spruce in Saxony, it is important that foresters should know the exact facts ascertained in order to avoid misapplication of theories based on them. The work also has a bearing on many problems of agricultural practice and of plant nutrition in general. For these reasons Messrs. Faber and Faber are to be congratulated on making the papers so readily available. The book is well made and the plates excellently reproduced.

E. W. J.

11.44. Surface Humus

11.44. HARTMANN, F. *Waldhumusformen. [Types of forest humus.] Z. ges. Forstw.* 76 [70], 1944 (39-70). [G.]

A general article in which the different types of forest humus are described. A detailed bibliography is given.

11.44. KUBIŠNA, W. *L'investigation microscopique de l'humus. [The microscopic investigation of humus.] Z. Welforstwirt.* 10, 1943 (387-410). [F.g.e.]

FUNDAMENTAL NATURAL LAWS OF THE FOREST

In this lecture, given at the German Institute in Paris, the author argues that a specialized microscopic technique can assist in the development of soil research, notably the study of humus formations. The simplest method of such research is the microscopic examination of undisturbed soil with direct lighting (Auflichtmikroskop); this method has a number of advantages. Other methods are:—(1) The microtome technique, the application of which, however, is limited to humus free from mineral particles. (2) The ground section technique (Dünnschliffpräparat) which can be applied to all soil and humus formations; the humus or soil is impregnated with hardening substances and ground in much the same manner as rock fragments.

Direct microscopic investigation reveals the very great influence of the microfauna on humus formation. In most soils the decomposed humus consists to a large extent of excrements; knowledge of the size and shape of the excrement of the different soil animals is therefore important for an understanding of the biology of humus formation. Thin sections also permit a quantitative evaluation of the various constituents of the material by using the geometrical method originally developed by A. Rossival for the investigation of rock sections.

11.44 : 11.42. SÜCHTING, H. Über Zersetzungs- und Humusbildungsvorgänge bei Waldstreu, A₀-Humusarten und Vergleichs- und Modellstoffen. [The processes of formation and decomposition of humus in forest litter, A₀-humus and related materials actually or supposedly capable of humification.] *Bodenk. Pfl.-Ernähr.* 32, 1943 (243-95). [G.] S. & F. 7 (131).

Data on loss of organic matter from dead leaves and A₀-humus of Beech, Spruce and Pine held at two temperatures, at two percentages of water, and with and without lime, for 7, 13 and 25 months showed no very marked differences except for a more rapid loss at 35° than at 15°; in general, however, litter and humus from better soils lost more than materials from poor soils. The percentages of C and H in all samples after 25 months were substantially the same, and equal to the initial percentages. Losses were greatest in the first year. Hydrolytic acidity and pH of the exchange acidity for the three kinds of humus after 25 months under the same treatments, and for oat hay, casein, cellulose and a lignin preparation are recorded, as are the changes in total N for the same materials after 2 years (one year's humification for some of the comparative materials). Nitrification was often very active, acid conditions and the presence of much soluble decomposable matter not inhibiting it. The hypothesis is put forward that the decomposition of protein leads, by the splitting off of side chains from the protein nucleus, to the formation of difficultly decomposable N compounds representing an intermediate stage in the formation of N-containing humic acids.

11.47. Maintenance of Favourable Soil Conditions

11.47.12 : 11.43.1 : 23.26.4 : 12.25. RAYNER, M. C. The use and significance of composts in forestry. *Ann. appl. Biol.* 30, 1943 (397-9). O.R.S.

The addition of various composts to poor heath soil on Bagshot sands at Wareham Forest, Dorset, has resulted in greatly improved growth of Pines and other conifers planted on this site. As a result of numerous experiments the author has come to the conclusion 'that the remarkable effects on tree growth brought

about by these composts on natural soils such as those at Wareham Forest and elsewhere, and also in various nursery soils, their uniformity, magnitude, and persistence over a number of growing seasons, do not depend to any extent upon the addition of nutrients, but are directly bound up with qualitative changes in the humus constituents and the biological activities related with these; possibly also with the presence of growth-promoting substances in individual composts or produced in the soil as a result of fungal activation'.

11.47.13 : 11.42.1 : 11.62. HEINRICH, F. Untersuchungen über den Einfluss der Basalt- und Geschiebemergel düngung auf den Wasserhaushalt und Bodenzustand sandiger diluvialer Waldböden Ostdeutschlands. [Investigations on the effect of fertilizing with basalt and marl rubble on the water economy and soil condition of sandy diluvial forest soils in eastern Germany.] *Z. ges. Forstw.* 75 [69], 1943 (183-213). [G.] [Bodenkundliche Institut der Forstlichen Hochschule, Eberswalde.]

Heavy applications of the one or other of these fertilizers on two different soils of this type had a significant effect only in increasing somewhat the content of mobile mineral plant nutrients in the surface layer of the soil (as observed 1½ years after fertilizing); there was no significant improvement in water conditions.

11.47.6 : 11.47.12 : 12.25 : 11.43.1. NEILSON-JONES, W. Biological aspects of soil fertility. *J. agric. Sci.* 31, 1941 (379-411 + plates). [Bedford College, Univ. of London.] O.R.E.

A detailed account is given of an experimental study of soils at Wareham Forest, Dorset, an area of poor *Calluna* heathland which is at present under afforestation by the Forestry Commission of Great Britain. The growth of Pines sown or planted on untreated soil is generally very poor, but here and there isolated trees or groups of trees show fair development on ground otherwise characterized by almost complete suppression of growth. The inhibition of growth shows no correlation with any obvious soil features such as local deficiencies in organic nutrients. There is evidence, however, of reduction in the number of species and activity of the fungi present, sporophores of the higher fungi being notably rare, and mycorrhizal associations with the young Pines deficient in number and abnormal in structure. The fertility of the soils, as reflected in tree growth, appears to be controlled by the nature of toxic organic residues derived from micro-biological action. Modification of these residues by compost treatment (or, to a less extent, by improved aeration and drainage) brings about marked activation of growth of the higher fungi and the resumption of normal mycorrhizal development, with a resultant increase in growth and short root production on the part of the young Pines. The alteration in the character of the decompositions is self-propagating and the effects on growth are persistent.

11.47.6 : 11.47.13. SÜCHTING, H. Die Ernährungsverhältnisse des Waldes. [The nutrition of the forest.] *Allg. Forst- u. Jagdztg.* 119, 1943 (29-42, 64-75). [G.g.] [Institut für Forstliche Bodenkunde der Universität Göttingen.]

A general article based on recent literature. It is stressed that the fertility of most forest soils depends to a large extent on the degree of degradation, expressed in leaching and related phenomena, and that liming is an effective means of counteracting degradation.

FUNDAMENTAL NATURAL LAWS OF THE FOREST

11.6. Hydrographical Conditions. Water and Soil Conservation

11.62 : 91.3 : 12.19.2-3 : 12.26-8. DUNFORD, E. G., and NIEDERHOF, C. H. Influence of Aspen, young Lodgepole Pine, and open grassland types upon factors affecting water yield. *J. For.* 42, 1944 (673-7). [Rocky Mountain Forest and Range Exp. Sta., Fort Collins, Colorado.]

A sample-plot study was made to determine the effects of three different cover types (Aspen, open grassland, and young Lodgepole Pine) in intercepting precipitation (a factor of major importance affecting loss of storage water). It was found that the Aspen and open grassland types both intercepted less precipitation than did the coniferous cover, and are probably superior to the latter on burned and cut-over lands in the Rocky Mountains where water supply is of greater importance than timber production.

11.62 : 11.41.3 : 11.47.2. HEINRICH, F. Ein neuer Weg zur Verbesserung der Wasserführung unkräutwüchsiger sandiger diluvialer Waldböden. [A new way of improving the water economy of sandy diluvial forest soils overgrown with weeds.] *Z. ges. Forstw.* 75 [69], 1943 (132-42). [G.G.]

A report on an investigation made at Eberswalde on a diluvial sand soil overgrown with *Calamagrostis epigeios*. The water content of the soil was measured over a period of 1½ years in plots where (1) the weed had been killed with 'Anforstan' (a chlorate poison) and (2) the weed cover had been removed mechanically. The water régime was found to be considerably more favourable where the soil was protected by the dead vegetation than where it was bare: thus in the 0-100 cm. soil layer the water content was 15 per cent. higher on the average, and 28-9 per cent. higher during specially dry periods, in (1) than in (2); the differences were even greater in the 0-20 cm. soil layer. It is pointed out that the water régime of the bare soil was very favourable as compared with that of soil covered with living weeds. It thus appears that the use of chemical weed poisons is a promising method of controlling drought in weed-infested soils. The application of 'Anforstan' did not appear to affect the rate of nitrification of the humus.

11.62 : 12.19.23. SCHUBERT, J. Bodendecke und Wasserhaushalt. [Ground cover and water relations.] *Z. ges. Forstw.* 76 [70], 1944 (35-5). [G.]

A report on measurements made at Eberswalde over a period of several years. For the different cover types the evaporation from the soil increased and the discharge diminished in the following order: bare soil, long grass, lawn, dense Pine plantation, water meadow. Discharge exceeded evaporation from the bare soil and from the area bearing long grass, while the reverse condition held for the other types of ground cover.

11.62 (86) : 23.3 : 12.25. Informe. Reconocimiento forestal de las cuencas de los ríos El Buey y Piedras u de las quebradas La María y La Ayurá, en el Departamento de Antioquia. [Report. Forest survey of the basins of the rivers El Buey and Piedras and of a María and La Ayurá gorges in the Department of Antioquia.] *Tierras y Aguas* 5 (59/60), 1943 (3-40). [Span.]

It is suggested that, partly for hydrological reasons, a certain proportion of the grasslands in these areas should be afforested with conifers, notably *Pinus radiata* and *Taxodium mucronatum*.

11.62.11 (44) : 12.25. LOWDERMILK, W. C. 'Les Landes' . . . *Amer. For.* 50, 1944 (380-2, 412, 414-5).

A brief history of the planting and fixation of 400,000 acres of shifting sand dunes in the coastal area of southwestern France and the reclamation by means of drainage and afforestation of waste marsh lands extending far into the interior.

11.62.11 (47.6) : 24.4. BASOV, G. F. Vliyaniye lesnykh zashchitnykh polos kamennoy stepi na regulirovaniye poverkhnostnogo stoka. [The influence of shelterbelts of the Kamennaya Steppe on the regulation of surface run-off.] *Lesnoye Khozyaystvo* No. 2, 1941 (8-18). [Russ.]

Observations on the relationship between forest and the water régime in this fairly level district of the Voronezh region were begun in 1892, and, with interruptions, have been continued to the present time. Measurements of surface run-off were made in the spring only. In comparison with a catchment area on the bare steppe, one with 6 per cent. of its area bearing shelterbelts had a significantly lower coefficient of run-off (7-year average of 0.362 as against 0.544); run-off was found to be quite insignificant on a third area of which 18 per cent. was covered with shelterbelts. Run-off appears to be checked most efficiently by belts that are located at right angles to its direction. On the Kamennaya Steppe only a part of the belts are so located, their primary purpose being to afford protection from drying winds.

11.62.11 (47.6) : 12.19.21-3 : 11.33. KOBEZSKI, I. D. Protivoerozionnaya rol' lesnoi i travyannistoy rastitel'nosti. [The influence of forest and grass vegetation in checking erosion.] *Lesnoye Khozyaystvo* No. 6, 1941 (17-20). [Russ.]

This article is based on a number of observations on run-off and sheet erosion in the Chernigov region. When snow cover was not persistent and severe frosts occurred, the depth of frozen soil on sloping ground tended to be less under a forest cover than in the open. In the forest the depth of litter and density of undergrowth were of greater significance in relation to depth of freezing than was the density of the stand proper.

Plantations established on previously cultivated soil on steep slopes had at the age of 38 years considerable effect in checking run-off; this beneficial effect was much greater in the case of broadleaved and mixed stands than of pure Pine stands. The presence of litter was essential to the efficient checking of run-off. On a slope of 15-16 per cent. a strip of forest 20 m. wide absorbed, during the winter and spring, a large proportion of the run-off and much of the eroded material from a 100-m. wide field located above it; under similar conditions a grass strip was less effective in controlling run-off and erosion.

11.62.11 (54.5). KITCHINGMAN, G. D. Soil conservation in the Punjab. *Indian For.* 70, 1944 (169-75). [Soil Conservation Circle, Punjab.]

A brief outline, district by district, of the soil conservation work being done at present by the Forest Department in the Punjab.

11.62.11 (54.5) : 92. KITCHINGMAN, G. D. Soil conservation in the Punjab (with special reference to legal and propaganda measures). *Emp. For. J.* 23, 1944 (20-6).

Problems in getting Government and popular support to undertake soil conservation work are discussed briefly and some details are given of Punjab legislation

FUNDAMENTAL NATURAL LAWS OF THE FOREST

(the Punjab Land Preservation (Chos) Act of 1900) which empowers the Government to prevent the misuse of land by villagers.

11.62.11 (8). MAES, E. E. Soil conservation in South America. *Agric. in Americas* 3, 1943 (123-7).

A brief survey of the main problems and activities relating to soil conservation in each of the South American countries. As a result of the Eighth Scientific Congress which met in Washington in June, 1940, a Pan American Soil Conservation Commission has been set up to co-ordinate and encourage anti-erosion activities in South America.

12. FOREST BOTANY. TREE SPECIES

12.1. General Botany

12.11. Physiology. Reproduction. Growth

12.11.1. *Metabolism. Plant Constituents. Sap Flow. Growth Substances. Reserve Materials*

12.11.1 : 21.3. HOAGLAND, D. R. Lectures on the inorganic nutrition of plants. (Prather lectures at Harvard University.) Chronica Botanica Company, Waltham, Mass., U.S.A. 1944. pp. 226. [Univ. of California.] Price \$4.00.

12.11.11 : 12.14.7 : 12.26-8. COLIN, H., TANRET, G., and CHOLLET, M-M. Sur le catalposide, hétéroside des fruits du Catalpa. [On catalposide, the heteroside from the fruits of the Catalpa.] *C.R. Acad. Sci. Paris* 216, 1943. (677-9). [F.] P.R.

An account of the properties and distinguishing characters of catalposide, a heteroside formed from *d*-glucose β and an unstable aglycone. It was first obtained by Claesen in 1888 from the fruits and root of *Catalpa bignonioides* Walt. (*Bignonia catalpa* L.)

12.11.11 : 12.26-8. QUÉTEL, R. Lipides of the Horse Chestnut. Methods of extraction and the technique for determining the fat acids. *Bull. Soc. Chim. biol., Paris* 25, 1943 (223-6). Chem. Abstr. 38 (2516). P.R.

12.11.11 : 12.14.5 : 12.26-8. WALLIHAN, E. F. Chemical composition of leaves in different parts of Sugar Maple trees. *J. For.* 42, 1944 (684). [Cornell Univ.]

While chemical analyses of leaves of three Sugar Maples (*Acer saccharum*) showed differences in nitrogen and potassium contents of basal and tip leaves on a given twig and considerable variation in calcium content of different leaves, no correlation was found between chemical composition of leaves and the position on a branch, the height of the branch, or its direction from the trunk. It is suggested that a random sample of 50 to 100 leaves from the most accessible part of the crown would give representative data.

12.11.13. BOSWELL, J. C. A note on the thermodynamic aspect of respiration. *New Phytol.* 43, 1944 (13-4). [The University, Sheffield.] O.B.D.

12.11.2. Propagation. Growth. Development

12.11.21 : 12.14.1 : 12.25. DOYLE, J., and KANE, A. Pollination in *Tsuga pattoniana* and in species of *Abies* and *Picea*. *Sci. Proc. R. Dublin Soc.* 23 (n.s.), 1943 (57-70 + plates). [Univ. Coll., Dublin.] O.R.S.

Observations are made on ovular structure in relation to pollen reception and pollen behaviour in *Tsuga pattoniana*, *Abies nordmanniana*, *Picea excelsa*, *P. orientalis*, and other species of *Abies* and *Picea*.

12.11.22 : 12.25. ANDRONOV, N. N. Vegetativnoe

razmnozhenie listvennits. [The vegetative propagation of *Larix* spp.] *Lesnoe Khozyaystvo* No. 11, 1940 (37-40). [Russ.]

In experiments with cuttings consisting of entire shoots of 9 *Larix* species, higher rooting percentages were obtained in hotbeds than in boxes with sand. Comparatively high percentages of rooted cuttings were obtained with several species, but strong root development was obtained only with cuttings from two-year-old seedlings of *L. sibirica*. All other cuttings (taken from 15- and 30-year-old trees of different species including *L. sibirica*) showed poor root development.

12.11.22 : 12.26-8. EDGERTON, L. J. Two factors affecting rooting of Red Maple cuttings. *J. For.* 42, 1944 (678-9). [Allegheny Forest Exp. Sta., Philadelphia, Pa.]

The data presented in this article indicate (a) that cuttings from the lower half of the crown root more readily than those from the upper half for both male and female trees of Red Maple (*Acer rubrum*); (b) that cuttings from trees with a light fruit crop root better than those from trees with a heavy fruit crop; and (c) that rooting ability is not associated genetically with sex. [Cf. *For. Abstr.* 3 (108); 4 (217).]

12.11.22 : 12.26-8. IVASHCHENKO, A. I. Opýt privivki kashтана s'edobnogo na kashтанolistnom dube. [An experiment on the grafting of *Castanea sativa* on *Quercus castaneifolia* stocks.] *Lesnoe Khozyaystvo* No. 11, 1940 (67-9). [Russ.]

A report on recent experiments carried out in Azerbaijan. Only a small percentage of the grafts survived the first summer, no doubt owing largely to the severe drought and insect attack that occurred at the time. The survivors grew very rapidly during the first summer; this proved a disadvantage, as the grafts were readily torn away by the wind. It is thought that future experiments must aim at obtaining a slow growth rate until the grafts become firmly anchored in their stocks. During the second and third years the growth rate of the remaining grafts diminished rapidly and many of them died. Further work is required to determine whether the grafting is practicable.

12.11.22 : 12.25-8 : 12.11.15. ČAJLAHAN, M. H., and TURECKAJA, R. H. Brief instructions for rooting cuttings with the aid of synthetically prepared plant growth substances. *Publ. Timiriazev Inst. Plant Physiol. Acad. Sci. U.S.S.R.* 1942. pp. 32. [Russ.] Hort. Abstr. 14 (453).

The concentration of growth substance used, whether β -indolylacetic acid, β -indolylbutyric acid, or α -naphthaleneacetic acid, should be greater for woody than for herbaceous cuttings. All are toxic if too concentrated, or if cuttings are immersed in the solutions for too long. Cuttings root best when taken from young shrubs and trees, those taken from young trees rooting better than those taken from young shoots of old trees. Water solutions enable many cuttings to be treated simultaneously and are the most convenient of the three forms (liquid, powder and paste) described. There should be the least possible delay between taking the cutting and treating it, and between treatment and setting in sand or mould. Temperature, air and moisture are the main considerations after the cuttings have been set. For most cuttings, temperatures of 18° to 35° C. are suitable. Willows need temperatures of 16° to 18° C.; the Citrus species, Cinchona and *Euonymus japonica*, 25° to 30° C. Holly at 15° C.

FUNDAMENTAL NATURAL LAWS OF THE FOREST

roots in 42 days, at 20° C. in 28 days, at 24° C. in 21 days, and at 27° C. in 18 days. Adequate lighting is especially important for summer cuttings with leaves and for evergreen woody cuttings. The light should be diffused. The propagation of a number of woody species with the aid of plant growth substances is discussed; these include *Euonymus japonica*, *Salix caprea*, *Pinus*, *Taxus*, and other conifers. There is also a list of plants with information about each regarding optimum concentration of and period of immersion in the solutions of the substances, and the ratio of success in treated and untreated cuttings.

12.11.22 : 12.25-8 : 12.11.15. KORDS, H. Verwendung der Wuchsstoffe zur Stecklingsvermehrung immergrüner Laub- und Nadelhölzer. [The use of growth substances for the propagation of evergreen broadleaved and coniferous cuttings.] *Gartenbauwiss.* 17, 1943 (240-9). [G.g.] E.M.B.

A report on experiments with lignified cuttings collected in the second half of October. The dipping of cuttings of *Erica carnea*, *Buxus sempervirens*, and *Chamaecyparis lawsoniana* for 16 hours in a weak solution (0.01, 0.005, or 0.0025 per cent.) of β -indolylacetic acid, of its potassium salt, or of β -indolylbutyric acid, influenced their rooting very favourably despite advanced lignification; with their better root development the treated cuttings produced much stronger plants than untreated controls.

12.11.22 : 12.26-8 : 12.11.15. TURETSKAYA, R. KH., and MAKSIMOV, N. A. K voprosu ob ukorenении cherenkov iby koz'ey (*Salix caprea* L.). [On the question of the rooting of cuttings of Sallow (*Salix caprea* L.).] *Sovetsk. Bot.* No. 5, 1943 (58-60). [Russ. russ.] O.B.D.

While untreated cuttings of this species showed practically no root formation, those treated with hetero-auxine solutions gave very high rooting percentages (up to 80 per cent.). The most favourable concentrations were 10 and 20 mg. of the chemical per 100 cc. of water for treatment periods of 48 and 24 hours, respectively. Rooting was best with cuttings collected in September; those taken in spring or summer proved unsatisfactory.

12.11.22 : 12.26-8 : 12.11.15. WILLIAMS, H. H. Studies on the propagation of certain broadleaf evergreens with special reference to leaf-bud cuttings and root inducing substances. *Proc. Amer. Soc. hort. Sci.* 43, 1943 (323-30). [Hampton Institute, Hampton, Va.] E.M.B.

Leaf-bud and stem cuttings of a number of broadleaf evergreens were treated with the growth substances Hormodin I, II, and III, and Rootone I and 10. No distinct advantage was found in the mechanics of application in using dust as compared with a liquid vehicle, but in order to obtain a more even application dust-treated cuttings had to be dipped in relatively small lots.

Roots of dust-treated cuttings were usually longer and more branched than those of cuttings treated with solutions, but a slightly higher percentage of the solution-treated cuttings struck root.

Leaf-bud cuttings compared favourably with stem cuttings in most of the species tested, particularly with regard to shoot development. The best response to all treatments was shown by cuttings from current wood. There was no significant difference in the performance of terminal and lateral buds of current growth.

12.11.23 : 12.14.4 : 12.25 : 42.21. BURGER, H. Johannistriebe der Lärche. [Lammas shoots of Larch.] *Z. ges. Forstw.* 76 [70], 1944 (10-2). [G.]

It has been observed in Switzerland that lammas shoots, which develop from the terminal buds of current terminal shoots, are commonly formed by fast-growing Larch species and races, such as the Japanese, Sudeten, and Polish Larches, and less commonly by slow-growing Larch species; and that, within a given race, only the stronger plants form such shoots. Often the lammas shoots are not lignified by September or the beginning of October, and are thus very sensitive to early frost.

12.11.23 : 12.26-8 : 56.02 : 11.1. BEILMANN, A. P. Some hourly observations of tree growth. *Ann. Mo. bot. Gdn.* 30, 1943 (443-51). [Missouri Botanical Garden Arboretum.] Liv.U.

By correlating data obtained from several thousand weekly weather charts and from growth and pressure measurements as recorded by the dendrograph and other recording instruments, observations were made on the effect of such factors as air temperature, relative humidity, hourly wind movement, barometric pressure, precipitation, sunshine, and soil temperature on the physiological responses of Bur Oak (*Quercus macrocarpa* Michx.).

12.11.23 : 12.14.3 : 12.26-8. BONNER, J. Culture of isolated roots of *Acacia melanoxylon*. *Bull. Torrey bot. Cl.* 69, 1942 (130-3). [California Institute of Technology, Pasadena, Calif.] O.B.D.

Isolated roots of *Acacia melanoxylon* were cultivated for periods up to 35 weeks in a liquid medium containing inorganic salts, 2 per cent. sucrose, and supplements of thiamin, pyridoxine and nicotinic acid. The growth rate averaged 8 ± 0.3 mm. per week over a period of 35 weeks. This growth rate, which was about two-thirds that of roots of seedling plants, was in marked contrast to the 40-150 or more mm. per week typical of isolated roots of some herbaceous species. No formation of branch roots or extensive secondary thickening was observed. Continued growth *in vitro* could not be obtained with isolated roots of 12 other species of woody plants, with the exception of rare individual roots of *Sterculia diversifolia*, *Bauhinia purpurea* and *Wistaria sinensis*. From author's summary.

12.11.3. Heredity. Breeding. Hybridization. Races and Questions of Provenance

12.11.3 : 12.11.23. NIKITIN, I. N. O novykh ideyakh v drevovodstve i lesovodstve. [On new ideas in arboriculture and silviculture.] *Lesnoe Khozyaystvo* No. 5, 1941 (4-14). [Russ.]

The author discusses from a forestry point of view the teachings of Michurin and Lysenko, according to which (1) woody plants develop in several physiologically distinct phases and the genotype of the plant can be altered at certain stages of its development by creating special environmental conditions, and (2) the bearers of hereditary characters are not genes but entire cells.

12.11.3 : 12.25 : 21.11 : 12.11.23. LANGLET, O. Photo-periodismus und Provenienz bei der gemeinen Kiefer (*Pinus sylvestris* L.). [Photoperiodism and provenance of Scots Pine (*Pinus sylvestris* L.).] *Medd. Skogsförsöksanst. Stockh.* 1942-43, No. 33, 1944 (295-330). [G.s.w.]

FUNDAMENTAL NATURAL LAWS OF THE FOREST

The study of variation in trees of different provenance is of importance in determining the adaptability of different climatic races for cultivation and in organizing breeding operations. The present paper deals with data already published on photoperiodism in the Pine and new material as well. The aspects of the problem treated include: photoperiodism and vegetative development and flowering; and the significance of the endogenous rhythm for the development of the Pine and the differential behaviour of Pines of different provenance.

The induction of flowering by strangulation is also discussed with reference to provenance.

A list is given of the features in which Pines of northern and southern provenance differ.

M. L. C. W.

12.11.3 : 12.25 : 56 : 21.61. LINDQUIST, B., and MALMBERG, E. Bättre frö för framtidens tallskogar. [Better seed for future Pine woods.] Svenska Skogsvårdsföreningen & Lantbruksförbundets Tidskriftsaktiebolag, Stockholm. 1943. pp. 11 + figs. Price 25 öre. C.G.B.

Genotypic variation, the effect of environment and the application of the laws of breeding are outlined. Better seed of forest trees is needed and in Pine breeding the aims are rapid growth and a desirable branching habit. The method originally used for improving timber quality and increasing volume increment, viz. (1) selective thinning and (2) the choice of cones from single trees and stands of the desired type, produced only small quantities of seed. To obtain high-grade seed in sufficient quantities for the whole country in a few decades, large-scale multiplication of progeny-tested Pines with the desired habit of growth and branching is therefore used. By this procedure very large numbers of small grafted trees of suitable type can ultimately be obtained, and can be induced to flower and set cones by strangling at the base of the stem with thick steel wire. From a plantation of such trees, 1 ha. in area, about 50 kg. of prime seed can be expected annually.

The systematic search throughout Sweden for élite Pines of the required type, the collection of seed from them, and the testing of their progeny for rapidity of growth so that only the best may be retained, have now been begun, and all interested in the promotion of Swedish forestry should co-operate. M. L. C. W.

12.11.3 : 12.26-8. DUFFIELD, J. W. Polyploidy in *Acer rubrum* L. *Chron. bot.* 7, 1943 (390-1). [Northeastern Forest Exp. Sta., New Haven, Conn.] O.B.D.

Acer rubrum is a highly polymorphic species occupying a wide range of habitats in the eastern United States, southeastern Canada, and a portion of Newfoundland. The first indication of intraspecific polyploidy in *Acer* was given in 1920 by Taylor, who reported gametic chromosome numbers of approximately 36, 54, and 72 in the genus, although multiples of 13 were more common. Subsequent investigations by various workers confirmed 13 as the basic number for the genus. Investigations carried out by the author showed that size and distribution of stomata were not reliable indices of naturally-occurring polyploidy in *Acer rubrum*. Reference is made to the possible effect of chromosome multiplication on wood quality and to the desirability of a detailed study of this aspect of polyploidy.

12.11.3 : 12.26-8 : 34.26. PADDOCK, E. F. On the number of chromosomes in *Hevea*. *Chron. bot.* 7, 1943 (412-3). Texas Agricultural Exp. Sta., Yoakum.] O.B.D.

In at least two root tips from each of six 18-month-old *Hevea* plants, the somatic chromosome number was found to be $2n = 36$. Since experiments have shown that tetraploidy is the optimum level (and *Hevea* species with $n = 18$ are believed to be tetraploids) it is unlikely that colchicine doubling will produce plants of superior latex-yielding capacity.

12.11.3 : 12.26-8. PERRY, B. A. Chromosome number relationships in the genus *Euphorbia*. *Chron. bot.* 7, 1943 (413-4). [Blandy Exp. Farm, Univ. of Virginia.] O.B.D.

A report on the cyto-taxonomy and phyletic relationships in the genus *Euphorbia*, based upon chromosome counts of 69 species and varieties. Speciation has attained greater development in this group of the Euphorbiaceae than in any other genus of the family, and it is probable that the wide chromosome variability ($2n = 12, 14, 16, 18, 20, 24, 28, 30, 40, 42, 56, 60, \text{ca. } 100, \text{ and ca. } 200$) has been largely responsible for the production of such diversity of form. The chromosome numbers probably belong to a primary system of $n = 8$ and to secondary systems of $n = 6, 7, 9$, and 10 which have arisen as a result of aneuploid loss or gain. The highest degree of polyploidy is found in the 7- and 10-lines (92 and 31 per cent., respectively). In the genus as a whole the frequency of polyploidy is about 40 per cent. There is a general correlation between high chromosome numbers and the perennial habit of growth. The greatest percentage of perennials is found among the species with the highest basic number, the 10-series. Cytological investigation seems to indicate that the sub-division of *Euphorbia* into at least three genera would be justifiable.

12.11.3 (43.1-5) : 12.25 : 56.1 : 21.8. RUBNER, K. Vorläufige Mitteilung über einen neuen Fichten-Provenienzversuch. [Preliminary report on a new Spruce provenance experiment.] *Z. ges. Forstw.* 76 [70], 1944 (28-32). [G.]

Data are given for Spruce of different German provenances grown at Tharandt, with special reference to height at the age of 7 years; the average height of the different provenances ranged from 40 to 88 cm. Observations were also made on the time at which the trees came into leaf, and on the dry weight of needles expressed as a percentage of their fresh weight.

The height growth of seed from the higher elevations was relatively less than that of seed of other provenance in the same forest area. It appeared that the elevation line dividing fast- and slow-growing races varies for the different mountain regions, being relatively higher in the more southern mountains of Germany; there was no evidence of a gradual decrease in height growth with increase in elevation of the provenance.

12.11.3 (47.2-6) : 23.21. AL'BENSKI, A. V. Gibrizdat-siya topoley v SSSR. Obzor. [Hybridization of Poplars in the U.S.S.R. A review.] *Bot. Zh. SSSR* 29, 1944 (86-90). [Russ.] O.B.D.

A review of the aims, methods, and results of Soviet research on the hybridization of Poplars. The principal aims have been to obtain fast-growing hybrids and drought-resistant hybrids capable of attaining a good

height and suitable for planting in the steppes. Satisfactory hybrids of economic value have been obtained from the following crosses:—

- ♀ *P. alba* × ♂ *P. bachofenii* and *P. tremula*.
- ♀ *P. tremula* × ♂ *P. alba*, *P. bolleana*, *P. bachofenii*, *P. laurifolia* and *P. canescens*.
- ♀ *P. nigra* × ♂ *P. alba*, *P. canadensis*, *P. simonii*, *P. suaveolens*, *P. candicans* and *P. tristis*.
- ♀ *P. pyramidalis* × ♂ *P. nigra*, *P. laurifolia*, *P. suaveolens*, *P. tristis* and 'Vislitsena' hybrid.
- ♀ *P. canadensis* × ♂ *P. nigra*, *P. pyramidalis* and *P. candicans*.
- ♀ *P. suaveolens* × ♂ *P. nigra* and *P. pyramidalis*.
- ♀ *P. balsamifera* × ♂ *P. alba*, *P. nigra*, *P. pyramidalis*, *P. canadensis*, *P. simonii* and *P. tristis*.
- ♀ *P. moskoviensis* × ♂ *P. nigra*, *P. pyramidalis* and *P. tristis*.

One of the tasks now confronting the investigators is to study the behaviour of the hybrids under actual forest conditions.

12.11.3 (47.6) : 12.25 : 56.01. LUBYAKO, M. N. Otkor bŷtro rastushchikh form i mestnykh drevesnykh porod. [The selection of fast-growing forms among local timber species.] *Lesnoe Khozyaystvo* No. 5, 1941 (28–32). [Russ.]

A report on investigations made with *Pinus sylvestris* in a district of White Russia. Considerable differences were observed in the average height growth of seedlings from seed of different mother trees, though examples of very good or very bad height growth were comparatively rare. In general, seed from high quality stands tended to give better seedlings than did seed from low quality stands. The hereditary growth capacity of seedlings could not be determined with any degree of certainty until they were at least 3 or 4 years old. In silvicultural practice good results can be obtained by establishing dense plantations which are later thinned to favour the fast-growing individuals.

12.11.3 (48.5) : 12.25 : 12.26–8 : 12.11.22 : 42.21 : 31.3. Årsberättelse över föreningen för växtförädling av skogsråd verksamhet under år 1942. [Annual report on the work of the Association for Forest Tree Breeding during the year 1942.] *Svensk PappTidn.* 46, 1943 (451–8, 477–83, 501–6, 535–41, 572–7). P.O.

The work of the Association was continued and co-operation was maintained with State and other institutions and workers concerned with forestry development. The following is a summary of some of the experiments, observations and results recorded in this report.

Spruce varies widely in branching habit and some of the variations have been found to be connected with valuable silvicultural characteristics: the comb Spruce shows the most vigorous growth and the least damage by rot and snow; the 'brush' Spruce* (borstgran) and 'band' Spruce* (bandgran) are nearly as vigorous, but both (especially the latter) are highly susceptible to rot. Both the northern European (Swedish) and central European (German) Spruces show parallel variation in branching habit and the superior vigour of the comb type. Provenance tests have confirmed the existence of many local Spruce races of different economic value, though the Spruce is less sensitive than the Pine to climatic and other environmental factors and therefore shows fewer Swedish local races than Pine.

* See *Bull. Yale Sch. For.* No. 40.

Commercial seed is obtained from comb Spruce (or trees resembling it) and parentage is guaranteed by taking seed only from élite trees in élite stands. It is estimated that the 1942–43 collection of cones organized by the Association from Ekebo will provide sowing material for 3 years, i.e. 2,500,000 plants of élite ancestry.

As a new advance in Spruce breeding, artificial crosses were made with trees nearly 30 m. high in an élite stand at Boserup, using scaffolding which will now make large-scale hybridization possible. The mother trees were two comb Spruces, one 'brush' Spruce, and one 'band' Spruce, all extremely pronounced types as regards their characteristic branching habit, and of the highest vigour. The objects of the crosses were: (a) to cross élite trees, using first-class pollinators, and compare the differences between their progeny and the offspring from open pollination; (b) to cross the most extreme types as regards branching habit and thus study its inheritance; (c) to cross German Spruce in the Boserup stands with first-class Swedish Spruce from Värmland and Dalarna, with a view to obtaining heterosis.

Bottle grafts with Larch were more successful than with Spruce and Pine, the best species for the purpose being *Larix leptolepis*. First generation interspecific Larch hybrids made in 1941 appear to confirm the good reports from abroad on such hybrids.

Hybridization work was continued with the main object of producing hybrids between the ordinary Swedish Spruce and foreign species, e.g. *Picea sitchensis*, *P. engelmanni*, *P. obovata*, *P. asperata*. New interspecific crosses of *Abies*, *Chamaecyparis*, and *Tsuga* were successful.

The severe winter of 1941–42 revealed a wide variation in the hardiness of the different provenances among the conifers brought from North America and planted out in comparison trials in various localities; this was especially true of Sitka Spruce and Douglas Fir. In the Kiviki-Esperöd arboretum the species *Abies concolor*, *A. nobilis*, *A. nordmanniana*, *Cryptomeria japonica*, *Picea orientalis*, *P. polita*, *P. schrenkiana*, *Thujaopsis dolobrata* and *Tsuga mertensiana* showed a remarkable range of reaction, some being more or less unaffected by the winter cold, others severely damaged or killed. A similar diversity was observed among conifers at Grensholm, e.g. *Abies alba*, *A. concolor*, *A. nordmanniana*, *Pinus contorta*, *P. jeffreyi*, *P. ponderosa*, and *Pseudotsuga taxifolia mucronata*.

Work with Poplar included the registering of valuable trees with normal chromosome numbers for use as parents in hybridization, the finding of four new triploid (giant) Aspens, and a number of crosses using both Poplar and Aspen material. Large-scale vegetative propagation of Aspen types was carried out with trees having the normal chromosome number as well as with giant triploids.

A total of 250 individual Birch progenies, comprising 105,000 one-year-old plants being grown at Ekebo, Brunsberg and Dalfors, showed great variation in growth increment, general vitality and resistance to rust; some progenies were markedly superior to the average. In 1942, a relatively large number of Birch hybrids, over 28,000 from about 20 crosses, were planted out. They comprised species crosses and crosses within both the main indigenous Swedish species; one-year-old plants from a few crosses of

FUNDAMENTAL NATURAL LAWS OF THE FOREST

Betula papyrifera with *B. verrucosa* or *B. pubescens* showed an average height of 50 cm. with a maximum of 70 cm.

Species and variety crosses of Alder produced a fairly large quantity of seed. *Alnus glutinosa* × *A. cordata* (from Denmark) was the best species hybrid, producing fine large plants. The same variation in photoperiodism was observed in both 1- and 2-year-old Black Alders (*A. glutinosa*) as had already been found among Aspens. The seedlings showed marked differences in increment, time of leaf fall and in lignification of the annual shoots. The Västerbotten Alder is a pronounced long-day type, as compared with the more southern and central Swedish Black Alders.

Bottle grafts of *Ulmus glabra*, *U. campestris*, *U. laevis* and *U. americana* were made, and subsequent hybridizations between the various species or between varieties exceeded expectations. The set from bottle grafting was better and more abundant than from cut branches. Propagation by greenwood cuttings gave good results, especially with hormone treatment of material from 2- to 3-year-old plants. At Kärrbogårde in Västerbotten an Elm was discovered with remarkably large leaves and branches, the offspring of which were triploids. Cytological examination showed that the chromosome number of this Elm was the normal 28 and the triploid forms were therefore probably due to the production of unreduced gametes in the parental generation. Triploids obtained by crossing normal individuals with the Kärrbogårde Elm may, it is believed, resemble the valuable giant Aspen in vigour of growth, and they are therefore being raised in large numbers.

The chromosome laboratory carried out chromosome determinations in connexion with (1) species crosses of Birch, Alder and Elm, and (2) colchicine-treated plants, including *inter alia* large numbers of Spruces as well as Elm and Birch.

Work of the chemical laboratory included analyses of material intended for use as parents in breeding. As material gradually becomes available from the breeding operations, the young plants will be examined to discover any differences in the chemical composition of the wood and in the structure of the fibre. Different clones of Aspen have been examined and a definite difference has been found in the chemical composition of the wood; the variation, which is genetically conditioned, is sufficiently large to be demonstrated by the methods of analysis used. In addition to cellulose, lignin and resin content, the pentosan content is now determined as well. Honey secretion studies in Sallow (*Hippophaë rhamnoides*), Maples and Lime (*Tilia cordata*) have been completed.

A large increment borer, 10 mm. in diameter, specially made for fibre measurements on living trees, has been found to break only a small part of the fibres.

Progress reports of work being done at the affiliated branch stations of the Association are also given.

M. L. C. W.

12.11.3 (485). ANDERSSON, E., Brunsbergsfilialen i verksamhet—dess förädlingsuppgifter. [The Brunsberg Branch Station starts work—its tasks in breeding.] *Svensk PappTidn.* 46, 1943 (343–51, 400–02). [Sw.] P.O.

Events leading up to the opening of this new station for the forest area in Värmland are recorded, with particulars of its equipment and facilities for breeding, cytological and silvicultural operations.

The surveys made by the Association for Forest Tree Breeding in Värmland during 1939–41 and its aims and methods are outlined and the application of genetics and cytology to tree breeding is explained. The technique of strangulation to induce flowering, which is based on Klebs' carbohydrate/nitrogen hypothesis, is described. The possibility of breeding disease-resistant forms is suggested with special reference to root rot of Pine and rust in the Birch.

M. L. C. W.

12.11.3 (485): 31.3 : 31.1. NILSSON, T. Skogsträdsförädling enligt kemiskt kvalitativa riktlinjer. [Forest tree breeding on the basis of chemical estimations of quality.] *Svensk PappTidn.* 46, 1943 (507–13). P.O.

This paper deals mainly with the methods of breeding for chemical characteristics of forest trees. The breeder's aim is to evolve new races of Swedish forest trees with wood of such chemical composition as will produce the best possible raw materials for the wood industries. Indications of the various lines along which breeding should proceed must come in each separate case from the technical experts in the different industries. For this reason the collaboration of the Scientific Academy of Engineers was sought and a committee of technical experts was set up to assist the Association for Forest Tree Breeding. A state grant was then asked for to study the influence of hereditary factors on the chemical composition of wood. This work was to be done at the central laboratory of the Cellulose Industry, in collaboration with the Forestry Institute and the Ekebo Institute.

The changes that might be effected in the chemical composition of wood by breeding may be broadly classed as:—(1) Alteration of the relative proportions of the constituents of the wood—affecting either the percentage weight or both the percentage weight and volume; (2) qualitative alteration of the main constituents of the wood, e.g. affecting the degree of polymerization of the cellulose, the composition of the resin substances or the pentosan content of the hemicellulose.

Undoubtedly genetic variation does exist in the chemical structure, but whether it is of such magnitude as to have any decisive effect or whether it is of such a kind as to have any practical value, is difficult to ascertain, as there have been few relevant investigations and little can be obtained from other types of wood analysis, partly because the experimental material was not selected for this purpose and partly because such varied methods of analysis were used that the values obtained are not comparable. Staudinger and Husemann (1941) determined the content of cellulose and skeletal substance and the degree of polymerization in different species of trees including the four species of *Populus*: *P. nigra*, *P. canadensis*, *P. tremula* and *P. alba*. *P. nigra* has a remarkably high cellulose content; *P. canadensis*, which holds an intermediate position, is a hybrid containing *P. nigra*, which perhaps explains its relatively high content. It was upon these results that Staudinger and Husemann based their favourable opinion on the possibility of breeding forest trees for chemical qualities.

Views are, however, more divided on the occurrence of variation within species, e.g. within *Picea abies* or *Pinus sylvestris*. Analysis of wood from individual trees showed that some variation did exist. Sampling errors, caused by the variation between trees and the error in the chemical analysis, render any conclusions more uncertain. Astrid Cleve von Euler (1923) found

FUNDAMENTAL NATURAL LAWS OF THE FOREST

quite a large variation in lignin content in both these species. P. Klason (1929) found some individual variation on determining the lignin content in a large number of Spruce trees from different parts of Sweden. Häggglund (1934 and 1935), in investigating the effect of the natures of the wood on yield and quality of cellulose, sulphite and sulphate, found differences in the chemical composition of wood in different trees as well as big differences in the yield of sulphate and sulphite pulp. This applied to both Spruce and Pine. Häggglund (1940) found in his investigation on the possibility of producing artificial silk pulp from Birch that in the sulphiting process there were individual differences between different trees. Birch with a definite curly grain formation had a different chemical composition from ordinary Birch. True curly grained wood can be regarded with certainty as being genetically conditioned. Otherwise such experiments only show that there is a certain diversity in the various species of trees but give no indication whatever as to how far it is due to modification or genotypic. No analysis of material from field experiments on strict genetic lines has so far been made.

In the absence of such experiments some conclusions can, however, be drawn from variation in cultivated stands of the same age. This method has been used at Ekebo in efforts to discover any plus-variants that might be suitable as initial material for breeding, and an experiment of this kind is described by the author.

The material consisted of 149 trees of 70-year-old planted Spruce from Wrams-Gunnarstorp in Scania. The stand comprised comb, brush (borstgran), 'band' (bandgran) and 'plane' (plangran*) Spruces. The experiment aimed also at determining whether there were any differences in the wood of these types.

Resin, lignin and cellulose content were determined by methods which are described. No differences were found between the wood from trees with different types of branching habit; thus the more vigorous comb Spruces apparently do not differ from the other types in chemical composition. On the other hand, quite big individual differences were noted, the resin content varying from 0.52-2.73 per cent., the lignin from 26.3-31.2 per cent. and the cellulose from 48.1-55.5 per cent.

Admittedly, the simplified methods of analysis used give quite large errors both in the chemical analyses and in the taking of the samples. In order to test the extent of these errors a special reproducibility test was carried out; however, even when causes of variation in experimental conditions were taken into account it was concluded that the differences found in chemical composition of the wood in the different trees in the experimental stand were statistically significant.

The degree of correlation between different constituents of the wood was examined. A statistically significant negative correlation was found between the cellulose content and lignin content. To what extent any deviations from the correlation are due to errors in the chemical analysis or exceptions to the rule is difficult to say. It is even more difficult to discover how far the differences found in the way described are genotypic. The more uniform the environment, the more likely it is that the differences found are hereditarily conditioned and that one or some of individuals among the plus-variants may be found to have the

desired genotype. In any event, there is every reason to assume as a working hypothesis the existence of many different types and in breeding operations the plus-variants discovered should be used as parents. Final proof can only be attained by comparative trials.

Light can be thrown on the interaction between environment and genotype by studying individuals vegetatively reproduced, e.g. Aspen clones. At Ekebo a small number of such clones from different districts were examined. Some were diploids and some triploids, i.e. the so-called giant Aspen. Discs were taken out at $\frac{1}{4}$ stem height and analysed. The results showed variation between trees of the same clone to be clearly less than between different clones. This applies especially to resin. Differences between clones from the same site must be regarded as being based upon genotypic differences.

Reference is also made to the possibility of changing the anatomy of timber by breeding, the present discussion being confined to the fibre size.

The average fibre length is known to be least next the pith. The length then increases quite rapidly in the first annual rings. Subsequently the increase falls off, and after the 30-40 annual ring the average fibre length remains fairly constant before diminishing somewhat during the period of the last annual rings in very old trees. If a fast-grown tree and a more compact one of the same dimensions are compared it will be found that the former is perhaps only 30 years old and has only the short fibres that are formed when the tree is young. The compact tree on the other hand may be 90 years old, and in it the majority of the fibres have arisen between the thirtieth and ninetieth year and are thus of maximum length. It is therefore quite understandable that fast-grown wood gives shorter fibres than compact wood, when trees of like dimensions are compared.

The situation is, however, reversed if annual rings are compared, each lying at a distance representing the same number of years from the pith. Determinations were made of fibre lengths on various fast-growing Pines from Småland, using discs taken at 2 metres above the ground. Different sections with a small number of annual rings were analysed, 100 fibres per macerated sample being measured for each section. It was then seen that, on comparing annual rings with the same number of rings, counting from the pith, the fast-growing ones had longer but also thicker fibres. The increase in thickness was proportionally greater than in length, so that the length/diameter ratio was to the disadvantage of the fast-grown wood. If the same figures are used to compare instead annual rings that lie at the same distance from the pith, the longest fibres will be found in the compactly formed trees. Thus in comparing two trees of the same dimensions the compact one will have the longer fibres, whereas on comparing two trees of the same age, the fast-growing one shows the longest fibres.

The increment of a tree must be regarded as being dependent on the number of cells produced and their size, i.e. it is a function of the rate of cell division and the capacity of the cell for elongation. In one case growth capacity is directly conditioned by an increase in cell sizes. Polyploid plants have, in general, larger cells than their diploid basic form. Measurements of individual cells, of the length of the stomata apertures or of the size of the pollen grains are also used to identify

* See *Bull. Yale Sch. For.* No. 40.

FUNDAMENTAL NATURAL LAWS OF THE FOREST

polyploids. In order to ascertain the effect of the chromosome number on the size of the wood elements H. Johnsson and the author carried out the following cell measurements on diploid and triploid Aspens: breadth (partly from sections and partly from macerated preparations); length (from macerated preparations); and breadth of wood ray cells (from sections). All these measurements showed that the cells of the triploid were significantly larger than those of the diploid. The calculated cell volume increase was about 50 per cent.

M. L. C. W.

12.11.3 (485) : 12.25 : 21.61 : 31.2. LINDQUIST, B. Die Rolle der Kiefer in der schwedischen Waldbaumveredlung. [The rôle of the Pine in Swedish forest tree improvement.] *Forstarchiv* 18, 1942 (293–302). [G.]

A general article on research up to 1939. The broad and narrow crown forms of Pine (*Pinus sylvestris*) occur together in stands throughout Sweden and are not segregated in the south and north of the country, respectively, as had earlier been supposed; the narrow crown form does, however, tend to be more abundant in the north. The timber quality of the narrow-crowned Pine is much the superior; calculations based on 1936 prices show that timber from such trees was between 11 and 400 per cent. more valuable than comparable timber from broad-crowned Pine. Present data suggest that in quantity production per ha. the narrow-crowned Pine is not inferior to the broad-crowned Pine. A study of stands bearing a high proportion of narrow-crowned trees was begun in 1938 with a view to organizing production of seed of controlled origin.

12.11.3 (485) : 57. PETTERSON, H. Växtförädlingen och skogsbruket. [Plant breeding and forestry.] *Skogen* 30, 1943 (31–7). [Sw.]

12.11.3 (485) : 57. SYLVÉN, N. Skogsskötsel och växtförädling. [Forest management and plant breeding.] *Skogen* 30, 1943 (148–9). [Sw.]

12.11.3 (485) : 57. ANDERSSON, E. Växtförädlingen och skogsbruket. Ett diskussionsinlägg. [Plant breeding and forestry. A contribution to the discussion.] *Skogen* 30, 1943 (178–80). [Sw.]

12.11.3 (485) : 57. PETTERSON, H. Skogsskötsel och växtförädling. [Forest management and plant breeding.] *Skogen* 30, 1943 (195–6). [Sw.]

The first of these papers on the relation between breeding and silviculture is a critical reply to an article 'Plant breeding and rational forest management' by Nils Sylvén [cf. *Skogen* 29, 1942 (347–9)] and a lecture by Nilsson-Ehle on increased production in Swedish forestry. The author emphasizes the importance of silviculture in stand improvement and of distinguishing between silvicultural measures and breeding operations, the latter generally to be confined to progeny tests carried out for purposes of study and to small-scale breeding for improvement. In conclusion he undertakes a statistical refutation of Nilsson-Ehle's assertion that the yield per hectare in Swedish forest stands could be increased in a relatively short time and that breeding applied to forest trees in nature can effect even greater improvements than with crops that have already undergone selection during centuries of cultivation.

Further discussion of the subject is given in the other three papers. Andersson criticizes in detail the statistical basis for Pettersson's argument and, in conclusion, presents formulae, based partly on recent work by O. Tedin, for determining under certain essential

conditions the effect of selection in the case of quantitative and qualitative characters. To obtain the necessary statistical data in such cases, however, progeny tests must (1) be laid out in the same locality as the original stand from which the progeny came, and (2) include trees from all height classes in the stand.

M. L. C. W.

12.11.3 (54) : 23.23.1. LAURIE, M. V. [The importance of seed origin.] Paper (I). *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 4, 1941 (103–9).*

12.11.3 (54) : 23.23.1. SEN GUPTA, J. N. [The importance of seed origin.] Paper (II). Summary of results to date of the All-India Co-operative Teak Seed Origin Investigation. With appendices and summary of debate on Item 4. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 4, 1941 (109–120, 120–1).*

In the first paper details are given of the characteristics of 24 species of Indian trees exhibiting individual and racial variation in the timber, growth form, hardness, yield of oil, resin or other minor products, etc., many of these variations being of commercial importance. The second paper discusses and summarizes in tabular form the results of an investigation on the influence of the origin of seed of *Tectona grandis* on plant development and the characteristics of the crop raised. For ease of establishment and early development it seems that seed of local origin is superior to that of distant origin within the natural range of Teak, but it is probable that for growth form, timber quality, branchiness and crop increment per acre, different origins will show trends independent of their early behaviour. Included is a key to the morphological differences in races of Teak based on leaf characters. The investigation is being continued and extended to all species showing inherited variations that deviate from the normal to an extent which may affect financial returns.

12.14. Organography. Morphology.

Anatomy. Histology

12.14 : 12.26–8 : 01.3. SPRAGUE, T. A. On the taxonomic value of the anatomical structure of the vegetative organs of the Dicotyledons. 7. A review. *Proc. Linn. Soc. Lond., 1942–43 155th Session, Part 3, 1944 (232–5).* O.B.D.

The author discusses the rôle of anatomical characters in determining the taxonomic classification of plants and enumerates certain conclusions reached by taxonomists on the relative taxonomic values of external characters, since these conclusions seem to apply equally to anatomical characters. He gives reasons for the predominant position assigned to external characters in the present system of classification, but recommends that the taxonomist should take into account any character—whether external, anatomical, cytological, chemical, ecological or physiological—which is likely to be of permanent value in plant classification. Anatomical evidence seems to be particularly desirable as an aid to the more satisfactory grouping of the families of Angiosperms.

Two separate systems of classification are suggested: (1) a practical system which would include all the families and be used for catalogues, enumerations, and the arrangement of material; and (2) a system serving as a basis for future research and including only such groups as appear to be natural after careful scrutiny of all available characters. Further groups would be

FUNDAMENTAL NATURAL LAWS OF THE FOREST

added to the latter system as evidence justified their inclusion.

12.14.4-5 : 12.26-8 : 01.3. METCALFE, C. R. On the taxonomic value of the anatomical structure of the vegetative organs of the Dicotyledons. 1. An introduction, with special reference to the anatomy of the leaf and stem. *Proc. Linn. Soc. Lond.*, 1942-43 155th Session, Part 3, 1944 (210-4). O.B.D.

In the past the chief interest in Britain in the anatomy of the higher plants has been in relation to physiological functions, and British taxonomists have only recently begun to make use of anatomy, though there are many practical reasons for doing so. Anatomical evidence is of great value in the interpretation of genera and families, and enables the botanical identity of commercial samples of economic plants, timbers, fibres, etc., to be established; microscopic features frequently give a clue to the affinities of herbarium specimens that are not accompanied by flowers and fruits; and finally a complete anatomical survey is a necessary preliminary to the interpretation of palaeo-botanical remains. For such purposes collections of permanent microscope slides are of fundamental importance. A brief list is given of the most useful characters of the leaf and stem. Anatomy may be of great value in phylogenetic studies. The polyphyletic origin of the Angiosperms, suggested by the slender geological evidence, tends to be supported by the fact that not all the characters that are generally believed to be primitive are confined to any particular family. Some families appear to be phylogenetically connected in the sense of having had a common ancestor; others provide no certain evidence of relationship, and may, in fact, possess no modern relatives, and their isolated position should be fully recognized in systems of classification. Our knowledge of anatomy has already advanced sufficiently to make worth while a re-investigation of early Angiosperms, whose anatomical structure has been preserved but whose affinities have never been well established.

12.14.5 : 12.26-8. LEIGHTON HARE, C. On the taxonomic value of the anatomical structure of the vegetative organs of the Dicotyledons. 5. The anatomy of the petiole and its taxonomic value. *Proc. Linn. Soc. Lond.*, 1942-43 155th Session, Part 3, 1944 (223-9). O.B.D.

Stress is laid on the potential value of anatomical features as an aid in determining the true affinities of a family or genus where floral characters alone are insufficient for this purpose. The taxonomic value of the petiole has been largely overlooked in the past. While its vascular anatomy has arisen primarily in response to mechanical needs (and is thus phylogenetically unimportant), the wide diversity of detail in the petioles of different plants nevertheless provides the taxonomist with highly constant characters which can be used as diagnostic features in certain cases. In the Proteaceae, for example, the anatomy of the young stem is so uniform that discrimination of genera by this means is difficult, if not impossible; whereas the petioles are sufficiently distinct to provide a ready means of recognition. Purely fortuitous anatomical characters such as are found in the 'trembling' petioles of the genus *Populus* are of particular value to the taxonomist.

12.14.7 : 12.25. CAIN, S. A., and CAIN, L. G. Size-frequency studies of *Pinus palustris* pollen. *Ecology* 25, 1944 (229-32). [Univ. of Tennessee.]

As the result of a study of variability in pollen of

Pinus palustris from widely-scattered localities in the eastern United States the author concludes that the size-frequency method of species identification is of limited application where species differ only slightly with respect to size characteristics.

12.14.8 : 12.25 : 12.11.11. LEHMANN, E., and WILKE, G. Untersuchungen an Kiefernborke. III. Mitteil. [Investigations on Pine bark. Part III.] *Cellulosechemie* 20, 1942 (73-86). [G.] [Univ. Berlin.] P.R.

Data obtained in investigations by the authors on the anatomy and chemical composition of Pine bark. There is a detailed bibliography.

12.19. Geographical Distribution. Plant Geography and Sociology

12.19 : 01.4. WYNNE, F. E. Methods of reporting plant distribution data. *Chron. bot.* 7, 1943 (426-8). [New York Botanic Gardens, N.Y.] O.B.D.

Difficulties encountered while making a survey of botanical literature for a floristic survey of the north-eastern United States have led the author to make some suggestions regarding methods of reporting plant distribution data in order to facilitate quick and accurate interpretation of the material. The title, contents, illustration, and documentation of articles reporting plant distribution are dealt with separately, and examples are given of points likely to cause confusion or loss of time to the reader.

12.19 : 11.21 : 11.3. TSCHERNIAK, L. Ozeanität und Waldkleid in Gebirgen. [Oceanic climate and the forest cover in mountain areas.] *Z. ges. Forstw.* 76 [70], 1944 (12-28). [G.]

The climatic differences between the outer slopes and the inner regions of major mountain areas often lead to considerable differences in the distribution of species within a given range of elevations; this is illustrated by examples from the central Carpathian mountains of Slovakia, the eastern Alps, the Black Forest, etc.

12.19 : 12.11.3 : 12.26-8. BALDWIN, J. T. Cytogeography of *Oxydendrum arboreum*. *Bull. Torrey bot. Cl.* 69, 1942 (134-6). [Univ. of Michigan, Ann Arbor, Mich.] O.B.D.

Oxydendrum arboreum is distributed east of the Mississippi River from New Jersey to Illinois and southward to the Gulf of Mexico and northern Florida. Throughout its geographic range the chromosome number was observed to be $2n = 24$.

12.19 : 23.3 (410) : 64. Ecological principles involved in the practice of forestry. *J. Ecol.* 32, 1944 (83-115). [British Ecological Society.]

A record of the discussion on this subject at a meeting of the British Ecological Society held on July 2, 1943, to which all members of the Royal Scottish Forestry Society, the Royal English Forestry Society, the Society of Foresters of Great Britain and the Empire Forestry Association were invited.

The greater part of the discussion centred around the two 'working hypotheses' put forward by Sir Roy Robinson in his paper 'Some ecological aspects of afforestation and forestry in Great Britain' [cf. *For. Abstr.* 5 (30)]. While agreeing in general with the principles stated in these hypotheses, the speakers differed to some extent in the degree of their acceptance and the interpretation of terms. Particular attention was given to the relation of pioneer and succession

FUNDAMENTAL NATURAL LAWS OF THE FOREST

species and to the problem of naturally occurring versus economically desirable species.

12.19 (47.2-3 : 71.9) : 12.25 : 12.26-8. HUSTICH, I. Skogsgränsproblemet. [The timber-line problem.] *Svensk bot. Tidskr.* 38, 1944 (131-2). [Sw.] O.B.D.

In a lecture delivered before the Swedish Society the author discusses the problem of the timber line in Labrador and in northern Europe. The periphery of the wooded region in Labrador is composed largely of *Picea mariana* and *Abies balsamea* interspersed in places with *P. canadensis* and *Larix laricina*, while the forest proper includes such additional species as *Betula papyrifera*, Aspen, Mountain Ash, *Pinus banksiana* and *Thuja occidentalis*, the two latter species being confined to the interior of the Peninsula.

Conditions in Fennoscandia and the Kola Peninsula are compared with those in the Ural-Petschora territory. In the Ural-Petschora territory Spruce is the main timber-line tree, Larch is common, and *Abies sibirica*, *Pinus sibirica* and *Alnus fruticosa* occur on the periphery of the forest. In Fennoscandia Larch and *Alnus fruticosa* are lacking, while Pine is common on the periphery of the wooded region where Birch is also an important species.

The climatic similarity between the Ural-Petschora territory and Labrador has resulted in some common vegetational features, including the dominance of a *Picea* species with the interspersed of a species of *Abies* in the timber-line belt of both regions.

12.19 (54.2) : 12.26-8 : 21. NAIR, K. N. R. A sin-ecological study of the forests of Mayurbhanj. *Indian For.* 70, 1944 (257-9).

The total area of Mayurbhanj State is 4,243 square miles, more than one-third of which is covered with forests, mainly of the moist deciduous type, with Sal (*Shorea robusta*) the predominant species. Two quality classes of Sal forest have been noted. In 'quality I Sal forest', which predominates in two-thirds of the hill districts, the average height of the pole crop is about 60 ft. Natural regeneration is good in fire-protected areas, but is generally patchy in areas subject to burning and erosion.

In 'quality II Sal forest' the canopy is partly open and the pole crop shows an average height of only 40 ft. This type is found mostly in the south and south-easterly aspects where Sal tends to give place to such species as *Xylia xylocarpa*, *Terminalia tomentosa* and *Anogeissus latifolia*. Regeneration is generally very poor, and the few seedlings that come up after the monsoon are either suppressed by the weed growth or killed by ground fires in the following year.

A third forest type, the mixed deciduous forest, covers a fairly large area of the hills. It is composed of about 40 tree species, the more common and valuable being *Xylia xylocarpa* (15 per cent.), *Anogeissus latifolia* (20 per cent.), *Terminalia tomentosa* (10 per cent.), *T. chebula*, *T. bellerica*, *Adina cordifolia* (5 per cent.), *Bursera serrata*, *Dalbergia latifolia*, *Gmelina arborea*, *Bombax malabaricum*, *Mitragyna parviflora*, *Lagerstroemia parviflora*, and *Schrebera swietenoides*. The *Xylia/Anogeissus* association occurs mainly in the drier parts where the soil is of poor quality, while the *Terminalia tomentosa/Adina cordifolia* association is found along streams, nullahs, etc. where water is available. There is a tendency for this third type of forest to extend into areas where Sal has been exploited. Regeneration of Sal is almost totally absent.

Generally speaking, Sal grows well in heavy, well-drained soils derived from acid rocks. It avoids epidiorite with a shallow soil covering, particularly on the drier south and south-east aspects.

12.19 (68.4) : 12.26-8 : 21 : 12.11.1 : 23.4. BAYER, A. W. The Thornveld tree: a note on plant adaptation. *S. Afr. J. Sci.* 39, 1943 (44-55). [Natal Univ. College, Pietermaritzburg.] P.O.

An ecological study of the vegetation of the Natal thornveld, with particular reference to modes of plant adaptation to the extreme conditions of drought, evaporation and temperature which occur in this habitat at certain seasons of the year. The dominant trees which have invaded these former grasslands seldom exceed 12-15 ft. in height and are usually rather widely spaced (20-60 or more yards apart). The most common dominants are certain *Acacia* species (e.g. *A. karroo*, *A. arabica*, *A. caffra* and *A. robusta*) and a few leafless succulent species of *Euphorbia*. Species of *Gymnosporia*, *Cassine*, *Doryalis* and *Zizyphus* are also common.

The author discusses different types of plant adaptation as exemplified in succulent and non-succulent species. Attention is drawn to the extensive root system of most thornveld trees, to the production by many species of thorns and axillary leaf fascicles, and to the water relations (specific conductivity, osmotic pressure, transpiration rate, etc.) of woody plants growing in this environment. The transpiration rate of thornveld trees is normally high but is subject to sharp fluctuations. As compared with forest trees, the trees of the thornveld show a much greater latitude of functional response to environmental changes.

12.19 (72 : 728 : 729 : 8). BEARD, J. S. Climax vegetation in tropical America. *Ecology* 25, 1944 (127-58). [Colonial Forest Service, Trinidad and Tobago.]

During work on the vegetation of Trinidad, a system of classification was worked out to include all the known climax types of vegetation in tropical America. Detailed descriptions are given of 24 formations, grouped under six main headings: (1) rain forest; (2) seasonal formations; (3) dry evergreen formations; (4) montane formations; (5) swamp formations; and (6) marsh or seasonal-swamp formations. Tables are given showing the correlation between the formations proposed by the author and those of Schimper (1903), Shantz (1923) and Barbour (1942). An analytical key for the recognition of formations in the field is appended.

12.19 : 12.26-8 (72 : 728 : 729 : 8) : 31.1. RECORD, S. J. Miscellaneous notes on tropical American woods. *Trop. Woods No.* 79, 1944 (105).

The notes deal with (1) an extension of the range of *Phyllostylon brasiliensis* Cap.; (2) *Billia* in Ecuador; (3) the discovery of *Humiria* in Central America; and (4) the presence of more or less concentric bands of included phloem in some specimens of *Pera bicolor* (Kl.) Muell. Arg.

12.19.1. Regional Floras, including Check Lists

12.19.1 (51) : 12.25-8. METCALF, F. P. Flora of Fukien and floristic notes on southeastern China. Lingnan University: New York, 1942. pp. ix + viii + 82 + 2 maps. Biol. Abstr. 18 (14244).

The first fascicle of a projected work, this covers only the Gymnosperms and the Casuarinaceae to the

FUNDAMENTAL NATURAL LAWS OF THE FOREST

Fagaceae in the Engler and Prantl sequence. Keys to the genera and species are provided, rather full synonymy for each species is given, together with brief descriptions, citation of collections and geographic distribution. Supplementing the data on species known from Fukien Province, numerous species found in neighbouring provinces are listed and briefly discussed. No new names appear.

12.19.1 (66.99). EXELL, A. W. *Catalogue of the vascular plants of S. Tomé (with Principe and Annobon)*. Printed by order of the Trustees of the British Museum, London. 1944. pp. xi + 428. Price 30s. net.

12.19.1 (7 : 8). RUSSELL, P. G. *Economic plants of interest to the Americas*. Names of crops plants used in the Americas. U.S. Office of Foreign Agricultural Relations. [n.d.] pp. 29. [E.Span.] [U.S. Bureau of Plant Industry.]

An alphabetically-arranged list of the vernacular and botanical names of plants cultivated in fields, orchards and plantations in the Americas.

12.19.1 (86) : 12.25. WOODSON, R. E., SCHERY, R. W. and Collaborators. *Flora of Panama*. Part II. *Ann. Mo. bot. Gdn.* 30-31, 1943-44 (97-576). Liv. U.

Fascicle I lists plants of the Cycadaceae, Taxaceae, Typhaceae, Alismaceae, Butomaceae, Triuridaceae and Gramineae, while fascicle II deals with the Cyperaceae, Palmaceae and Cyclanthaceae. The sole species representing the Taxaceae is *Podocarpus allenii* Standl., a large tree from the mountain forests of Panama. It attains a height of 35 m. or more with a trunk as much as 1.5 m. in diameter at the base.

In fascicle III the families dealt with are Araceae (Standley), Lemnaceae, Mayaceae, Xyridaceae, Eriocaulaceae (Moldenke), Rapateaceae, Bromeliaceae (L. B. Smith), Commelinaceae and Pontederiaceae.

12.19.1 (96.9) : 97.3 : 12.26-8. RIPPERTON, J. C., and HOSAKA, E. Y. *Vegetation zones of Hawaii*. *Bull. Hawaii agric. Exp. Sta.* No. 89, 1942. pp. 60 + maps. A.P.B.

This bulletin is based chiefly on the results of a vegetation survey of the range lands of Hawaii. It is intended primarily for use in the study and classification of pastures, but is of wider application. Following a general outline of the climate, soils and vegetation of the area, each zone of vegetation is discussed separately under three headings: climate, topography and soils, and vegetation. The main zones are as follows:—shrub, forest, parkland, bog, and the moss-lichen formation. The forest, which extends from about 1,000 to 7,000 ft. in altitude, shows considerable variation according to prevailing winds, rainfall, local temperature, lava flows, cultivation, and grazing. Along the gully bottoms Kukui trees (*Aleurites moluccana*) often form a conspicuous canopy. Koa (*Acacia koa*) grows well on the flatter islands at altitudes of 1,000-1,500 ft., and is a dominant species at altitudes of 3,500-6,000 ft. on the more mountainous islands of the Hawaiian group. Mamani (*Sophora chrysophylla*) occurs from 5,000 ft. up to the timber line (10,000 ft.). On new lava flows Ohia Lehua (*Metrosideros collina*) is the characteristic tree of the wet forests between 1,500 and 4,000 ft., while Algaroba (*Prosopis chilensis*) is found mainly along the dry alluvial coastal flats.

The bulletin ends with a discussion on the zonal characteristics of Hawaiian pastures, a table showing the distribution of species in the islands, and a biblio-

graphy. The table is divided into five sections (grasses and sedges; herbs; ferns; shrubs; trees), each section being arranged alphabetically under the scientific name of the species.

12.19.4. Succession

12.19.4 (410) : 12.26-8. FORBES, A. C. *The position of Oak in British forest succession*. *Emp. For. J.* 22, 1943 (103-11).

It is pointed out that there is considerable evidence to support the theory that a Scandinavian type of forest (Pine, Birch, Willow, Aspen, etc., followed by Oak, Ash, Elm and Hazel) gradually invaded the British Isles from the south and east after the period of maximum glaciation, that the Oak forest formed the predominant tree vegetation during the later Neolithic and Bronze ages, and that, except for the almost complete disappearance of Pine, the constituents of the British forest flora have not changed since that time. The species mentioned above and many subordinate species are at present found in natural woodlands and no doubt would have as extensive a distribution as in prehistoric times except for human interference. The various factors, human and otherwise, that may have affected the composition and density of the forest in this country during prehistoric times are discussed by the author with particular reference to Oak, which, either as scrub or high forest, has in the course of time reached every part of the country, including the poorest soils and up to elevations of 1,000-2,000 ft., but which seldom renews itself under shade beyond the seedling stage.

In referring to a paper 'Some ecological aspects of afforestation and forestry in Great Britain' by Sir Roy Robinson [cf. *For. Abstr.* 5 (30)] the author discusses briefly the rôle of pioneer species and the value of natural succession as a guide to management practices, giving examples of trends in natural succession of tree and ground vegetation in British woods. It is concluded that to use natural development as the main criterion for forest management may be very inefficient as regards both time and the satisfying of specific timber requirements.

12.2. Special [Systematic] Botany

12.21. Fungi

12.21 (410). *The need for encouraging the study of systematic mycology in England and Wales*. The British Mycological Society. 1944. pp. 12.

The history and present position of mycology in England and Wales is briefly reviewed, and a short account is given of the position of systematic mycology abroad. Stress is laid on the need for encouraging the study of systematic mycology at universities, central herbaria, and research stations, so that specialists may be available to deal with problems of industrial mycology, forest and timber pathology and medical mycology. Certain recommendations are made with the object of meeting the present need for trained mycologists.

12.21 : 44.3 : 12.26-8. ZOGG, H. Untersuchungen über die Gattung *Hysteroglyphium* Corda, insbesondere über *Hysteroglyphium fraxini* (Pers.) de Not. [Investigations on the genus *Hysteroglyphium* Corda, particularly on *H. fraxini* (Pers.) de Not.] *Phytopath. Z.* 14, 1943 (310-84). [G.g.] [Eidgenössische Technische Hochschule in Zurich.]

FUNDAMENTAL NATURAL LAWS OF THE FOREST

The study deals chiefly with the biology of *H. fraxini* and the systematics of the genus *Hysterographium*. *H. fraxini* is a non-specialized saprophyte requiring for its initial development the presence of dead tissue from which it spreads to living tissue only in the case of an already weakened host.

12.25. Gymnosperms

12.25 (410) : 21.9 : 31.2. HOWARD, A. L. The Yew tree (*Taxus baccata*). *Nature, Lond.* 154, 1944 (215-6).

A general discussion, mainly from the standpoint of history and legend, on *Taxus baccata*. This species is believed to be one of the longest-lived of British trees, and throughout the ages has been regarded as a symbol of death and burial. Its wood was formerly much in demand for the making of bows, although English Yew was generally considered inferior to Spanish Yew for this purpose. Reference is made to some particularly fine examples of Yew as an avenue tree.

12.25 (494). AUBERT, S. L'if dans le Jura. [Yew in the Jura.] *J. for. suisse* 95, 1944 (154-6). [F.]

A general discussion on the appearance, distribution and characteristic features of *Taxus baccata* in the Jura. Reference is made to the unusual fruit of this conifer, the toxicity of its foliage to horses, and the relationship of the species to *Ginkgo*.

12.26-8. Dicotyledons

12.26-8. PALMER, E. J. The species concept in *Crataegus*. *Chron. bot.* 7, 1943 (373-5). [Arnold Arboretum of Harvard Univ.] O.B.D.

The taxonomic problem of the species concept is not peculiar to the genus *Crataegus*. Certain other genera (e.g. *Rosa*) contain an even larger number of species, and in the case of some comparatively small genera, such as *Castanea* and *Fagus*, there is much difference of opinion among systematists as to the number of species and the value of the characters used to distinguish them. Hybridization occurs to some extent within the genus *Crataegus*, but it is no more common relatively than in many other genera. Allowance for a reasonable amount of variation between individuals of a species would simplify the taxonomic position by reducing many slightly divergent types to synonymy. While it is desirable that species should be defined as far as possible on the basis of genetic relationships, it is doubtful whether it would be practicable rigidly to follow genetic lines in all cases.

12.26-8. STANDLEY, P. C. The status of the genus *Leucostemon* Moc. and Sessé. *Trop. Woods* No. 79, 1944 (9-10). [Chicago Natural History Museum.]

The genus *Leucostemon* Moc. and Sessé is equated with the much older genus *Sloanea*, and the new combination, *Sloanea terniflora* (Moc. & Sessé) Standl., is proposed for it.

12.26-8 : 12.11.3 : 12.14 : 12.19. WRIGHT, J. W. Genotypic variation in White Ash. *J. For.* 42, 1944 (489-95). [Purdue Univ., Lafayette, Indiana.]

Tests were made in the experimental nursery of the Harvard Forest (Petersham, Mass.) with progeny of 155 White Ash (*Fraxinus americana*) from 28 localities in the eastern United States and Canada. Results showed the species to be composed of at least three ecotypes: (1) The northern ecotype, which grows from Michigan

to central Pennsylvania and New England, and northward; trees are diploid, show little winter killing, have a bushy root system, and lack any pronounced pubescence or anthocyanin development. (2) The intermediate group, which is found in a narrow belt through southern Pennsylvania, northern West Virginia and Ohio; trees are characterized by a moderate amount of winter killing, bushy root systems, high incidence of pubescence and lack of anthocyanin development. (3) The southern ecotype, which is found from Maryland to southern Indiana and southward; trees are very susceptible to damage from winter cold, and have tap roots, reddish petioles and leaves which are glossy above and pubescent below. Of 54 trees of intermediate or southern origin for which chromosome counts were made, 33 were diploids, 8 were tetraploids and 13 were hexaploids.

A high incidence of pubescence was found in the progenies of both glabrous and pubescent parents of the southern and intermediate ecotypes, and it is pointed out that the Biltmore Ash (*F. biltmoreana*) and White Ash, which differ only in pubescence, need no longer be separated either in taxonomy or in silviculture.

It is suggested that further study is required on local variations in inherent growth capacity of this species, and on the possible relation between polyploidy and variations in taxonomic characters and wood quality.

12.26-8 : 12.11.3 : 12.14 : 12.19. WRIGHT, J. W. Ecotypic differentiation in Red Ash. *J. For.* 42, 1944 (591-7). [Purdue Univ., Lafayette, Indiana.]

Nursery tests with the progeny of 20 Red Ash (*Fraxinus pennsylvanica*) from 9 localities in the eastern United States and Canada showed the species to be composed of at least three ecotypes: (1) The northern ecotype is found in Maine, Ontario, Michigan, Wisconsin and Minnesota, and presumably throughout the species' range to the north; its southern extent is unknown. Progeny were slow-growing and winter-hardy, and lost their leaves early in the autumn. (2) The southern coastal plain ecotype was represented by collections from Virginia, North Carolina and South Carolina. The seedlings were very subject to winter killing, were significantly taller at the end of the second year than those of (1), and were relatively more susceptible to deer browsing than the rest of the species. (3) The New York ecotype is intermediate between (1) and (2) with respect to winter hardiness and height growth.

The entire species is believed to be diploid ($2n = 46$). The genetic constitution of the Red Ash proved to be quite different from that of the White Ash, and variability within the progeny of any one parent tree was much less in *F. pennsylvanica* than in *F. americana*.

It was found that pubescence, the only character that separates *F. pennsylvanica* var. *typica* and *F. p.* var. *lanceolata*, is not true-breeding.

12.26-8 : 12.13 : 12.14.7. KAUSIK, S. B. Contributions to the embryology and floral morphology of the Proteaceae. *Chron. bot.* 7, 1943 (404-6). [Univ. of Mysore, Bangalore.] O.B.D.

Reference is made to the presence in the developing seed of *Grevillea robusta* and *G. banksii* of a vermiform appendage which is probably characteristic of the genus. This appendage assumes a haustorial rôle, causing the gradual destruction of the nutritive tissue within the seed. The appendage was absent in the two other

members of the Proteaceae studied (*Macadamia ternifolia* and *Hakea saligna*), but in *M. ternifolia* the lower end of the embryo sac was observed to form a number of lobes having a haustorial function.

Some characteristic features in the vascular anatomy of the flowers of *M. ternifolia* and *Grevillea robusta* are noted.

12.26-8 : 21.8. DAVIS, D. Early flowering of Semal (*Bombax malabaricum*). With note by the Assistant Botanist, Forest Research Institute, Dehra Dun. *Indian For.* 70, 1944 (313-4).

Record of a Semal tree (*B. malabaricum*) being in full flower on 17th November, 1943, at an elevation of about 4,500 ft. in a valley in the Kumaun Himalayas.

12.26-8 : 21 : 31.2 : 60.31 : 33.0. DAY, M. W., and VOGEL, F. H. Silviculture and utilization of Balsam Poplar. *J. For.* 42, 1944 (512-4). [Michigan State College, East Lansing, Mich.]

Balsam Poplar (*Populus tacamahaca*) is distributed across Canada and most of the northern United States. Although a species of low economic value, in the Lake States it has a definite place in the silvicultural treatment of low-lying lands subject to invasion by Alder and other swamp shrubs. The wood of Balsam Poplar is being increasingly used for purposes where strength is not important, particularly for box and crating material. It is reported to be an excellent pulpwood, but must be mixed with long-fibred sulphite pulp for the production of high-quality papers.

Management by the clear-cutting system is recommended. Data are given on silvicultural characteristics and wood properties of the species.

12.26-8 : 56 : 21.61. ROHMEDE, E. Wuchsleistungen männlicher und weiblicher kanadischer Pappeln im Gräflich von Preysingschen Forstbezirk Moos. [Yield of male and female Canadian Poplars in the Gräflich von Preysingschen forest district Moos.] *Forstwiss. Cbl. u. Thar. forstl. Jb.* No 6, 1943 (225-33). [G.g.] [Univ. München.]

In the four stands examined the male trees on the average surpassed the female trees of the same age by about 15 per cent. in height, 5 per cent. in diameter, and 20 per cent. in timber volume. The stem form was better in the male trees. The variety of Canadian Poplar in these stands has not been identified.

12.26-8 : 12.14. ETTER, H. Über die Unterscheidung nordschweizerischer Steil- und Traubeneichen nach vegetativen Merkmalen. [On the differentiation of *Quercus robur* and *Q. sessiflora* in northern Switzerland according to vegetative characters.] *Schweiz. Z. Forstw.* 95, 1944 (237-46 + plate). [G.]

A summary of the characters by which the two species can be distinguished.

12.26-8 (485) : 09.1 : 21.8. JOHANSON, Å. Eken. Trollväsens och Vasakungens skötebarn. [The Oak. The trolls' and Vasaking's favourite.] *Skogsägaren* 20, 1944 (169-72).

A popular note, from the historical aspect, on the Oak in Sweden and on various famous specimens, some of which are mentioned in the legends of the country. Efforts have been made to find a type of Oak that will flourish north of the Dal. A species with the shortest possible vegetation period is needed. It seems possible that many varieties exist from which, after further experiments, a suitable type could be chosen.

M. L. C. W.

12.26-8 (47.6) : 12.11.3 : 21.2 : 12.11.12 : 42.22. PVAITITSKI, S. S. Ekologicheskie tipy obyknovennogo duba i ikh ispol'zovanie v lesokul'turnoy praktike. [Ecological types of *Quercus robur* and their utilization in silvicultural practice.] *Lesnoe Khozyaystvo* No. 3, 1941 (14-23). [Russ.]

Three ecological types of *Q. robur*, encountered in the forest steppes of the Ukraine, are: (1) var. *tardiflora*, which is found in ravines and at low elevations generally, and is known to be relatively frost resistant; (2) var. *praecox*, which is found at higher elevations, on plateaux, etc.; (3) var. *praecox*, which grows under humid conditions in the river valleys. Studies of wilting and photosynthesis were made with seedlings of the first and second types under conditions of soil drought. The second type proved the more drought resistant: it wilted less readily, its optimum photosynthesis occurred at a considerably lower soil moisture, its rate of transpiration was lower under normal conditions, and it produced more dry matter per unit weight of water transpired, especially under drought conditions. The third type is believed to be even less drought resistant than var. *tardiflora*. These differences in the site requirements of the three types must be taken into account when using the species for afforestation.

12.26-8 (410) : 12.19 : 21 : 31.2 : 57. PENISTAN, M. J. Birch. *Quart. J. For.* 38, 1944 (78-88).

There are two distinct species of Birch in Great Britain—*Betula pendula*, which is relatively more abundant in the south, and *B. pubescens*, which, though locally abundant in the south, is the more common in the north and west. Both species occur most frequently on sandy soils, although *B. pendula* is found on most types of soil, including clays and limestones.

This article discusses the history, silvicultural properties, ecology, utilization, and yield of these species. Calculations of financial yield, using Continental yield tables, suggest that Birch from natural regeneration could be grown profitably under British conditions. Silviculturally, Birch is of value in that it controls the tendency of fertile brown earths towards podsolization, and is the source of one of the few known mycorrhizas on Pines in light heathy soils; being frost resistant it is a useful nurse tree for tender species.

12.26-8 (410) : 31.0. HOWARD, A. L. The Beech tree. *Nature, Lond.* 154, 1944 (492-4).

A general discussion on *Fagus sylvatica*, including historical references to the species and its timber. The wood of Beech has long been a favourite with chair-makers, and more recently it has come into prominence in the manufacture of plywood. The Copper Beech (*F. sylvatica* var. *purpurea*) and the Fern-leaved Beech (*F. sylvatica* var. *heterophylla*) are both highly valued as ornamentals.

12.26-8 (51). HUI-LIN LI. The genus *Cedrela* in China. *Trop. Woods* No. 79, 1944 (16-24). [Arnold Arboretum, Harvard Univ.]

Four species of *Cedrela* are known to occur in China—*C. toona* Roxb., *C. microcarpa* A. DC., *C. sinensis* Juss., and a new species, *C. rehderiana* Li. The range of each species is indicated and descriptions of the four species and their varieties are given.

12.26-8 (51) : 12.14. HUI-LIN LI. Taxonomy and distribution of the genus *Cercis* in China. *Bull. Torrey bot. Cl.* 71, 1944 (419-25). [Arnold Arboretum, Harvard Univ.] O.B.D.

FUNDAMENTAL NATURAL LAWS OF THE FOREST

Five Chinese species of *Cercis* are recognized: *C. racemosa* Oliver, *C. chuniana* Metcalf, *C. chinensis* Bunge, *C. chingii* Chun, and *C. pauciflora* Li. These are enumerated and discussed, with citations of all specimens examined. *C. chinensis*, a tree of the temperate regions, is the only species of *Cercis* which is widely distributed in China, the other four species being of rather limited occurrence. *C. pauciflora* (a shrub) is described as a new species.

12.26-8 (68.4). DYER, R. A. The third species of *Atalaya* in South Africa—*Atalaya natalensis* sp. nov. *S. Afr. J. Sci.* 39, 1943 (112-5). P.O.

Atalaya natalensis is a partially deciduous, high-forest tree reaching a height of about 12 m. and a trunk diameter of about 30 cm. at breast height. The species, which is described, was found in Ngomi Forest in the Vryheid district of Natal, where it is locally abundant.

12.26-8 (72) : 34.26. GILLY, C. L. *Virola guatemalensis* (Hemsl.) Warb. in Mexico. *Trop. Woods* No. 79, 1944 (5-8). [New York Botanical Garden.]

Virola guatemalensis (Hemsl.) Warb. is the first representative of *Virola* to be found in Mexico. Both the seed kernel and the aril which encloses the seed contain an oil, samples of which have been shown to keep for more than a year in the warm, humid climate of southeastern Chiapas without deteriorating. The oil from the kernel, which promises to be of use in the preparation of fine cosmetics, is being analysed.

12.26-8 (729.7) : 12.14.8. BEARD, F. S. Key for the identification of the more important trees of Tobago on characters of bark and blaze. *Emp. For. J.* 23, 1944 (34-6).

12.26-8 (81) : 12.19 : 12.11.3 : 34.26. DUCKE, A. Novas contribuições para o conhecimento das seringueiras ('Hevea') da Amazônia brasileira. [New contributions to the knowledge of *Hevea* species of Brazilian Amazonia.] *Arg. Serv. flor., Brasil* 2, 1943 (25-43). [Port.]

A renewed study of the *Hevea* species of the Brazilian forests in their native habitat has revealed the presence of certain hybrids of *H. brasiliensis* × *H. spruceana* growing vigorously on poor, acid soils where pure *H. brasiliensis* does not thrive. Amongst several thousand trees of *H. spruceana* observed, one hybrid of *H. benthamiana* × *H. spruceana* was found bearing mature capsules. A second specimen of *H. gracilis* (*H. benthamiana* × *H. guianensis marginata*) was found in Manaus.

Descriptions are given of the species and varieties found, with indications of their local names and geographical distribution. The new observations have shown the area of distribution of *H. brasiliensis* to be considerably greater than was formerly supposed. The three other important species are *H. benthamiana*, *H. lutea* and *H. guianensis*; the two latter may prove to be only varieties of a single species.

The hybrids also are described. M. L. C. W.

12.26-8 (81) : 31.1 : 34.26. MIRANDA BASTOS, A. DE. Os pauis rosa da indústria da essência. [The Rose-woods of the essential oils industry.] *Rodriguesia* 7 (16), 1943 (45-54 + plates). [Port.]

The author describes the tree species *Aniba rosaedora* and *A. duckei* and the anatomy of their wood, and gives data on the Brazilian export trade with the essential oils obtained from these species.

12.26-8 (82) : 12.19. EXELL, A. W. The Combretaceae of Argentina. *Lilloa* 5, 1940 (123-30 + plates). [Espan.] A.P.B.

The pan-tropical family, Combretaceae, is represented in Argentina by only four species: two lianes of the genus *Combretum* and two trees (or shrubs) of the genus *Terminalia* (*T. triflora* (Griseb.) Lillo, and *T. australis* Cambess.). All four species are restricted in range to the more northern provinces. A botanical description is given of each species as it occurs in Argentina.

12.26-8 (82). LOURTEIG, A., and O'DONELL, C. A. Euphorbiaceae argentinæ: Phyllanthaceae, Dalechampiaceae, Clurytieae, Manihoteae. *Lilloa* 9, 1943 (77-177 + plates). [Span.e.] [Instituto Miguel Lillo.] A.P.B.

In the present revision of the Argentine Euphorbiaceae a study is made of the genera *Phyllanthus*, *Aporosella*, *Dalechampia*, *Cnidioscolus*, *Jatropha* and *Manihot*. Among the woody species described are *Phyllanthus acuminatus* Vahl (a tree 10 m. in height), *Aporosella chacoensis* (Morong) Spegazzini (8-12 m.), and *Cnidioscolus vitifolius* Mill. (7 m.).

12.26-8 (82) : 12.14.4-7 : 31.0 : 12.19. SCHULZ, A. G. Las Bignoniceae del territorio del Chaco. [The Bignoniceae of the Chaco region.] *Lilloa* 5, 1940 (131-58 + plates). [Span.g.] A.P.B.

The family Bignoniceae is represented in the Chaco region of Argentina by two major growth forms—trees and lianes. The former include the commercially important timber species *Tabebuia ipe* (Lapacho or Tayi), and the unimportant related tree species, *T. nodosa*. The general family characters of stem, leaves, tendrils, inflorescence, flower (calyx, corolla, androecium, gynoecium), fruit and seed are described and discussed. Special reference is made to the properties and uses of the timber of *Tabebuia ipe*. A key to the indigenous species of the Bignoniceae is included, and the individual species are listed and described with notes on their distribution and habitat.

12.26-8 (91.1) : 31.0. SYMINGTON, C. F. *Pseudosindora palustris* (Leguminosae, Amherstieae), a new genus and species from Borneo. *Proc. Linn. Soc. Lond., 1942-43* 155th Session, Part 3, 1944 (285-8). O.B.D.

Pseudosindora palustris is a tall unbuttressed tree, reaching a diameter of about 6 ft. at breast height, reported from Sarawak and from the coastal freshwater swamp forests of Brunei. It resembles *Sindora* species in leaf and fruit characters and in wood anatomy, but differs from it in other respects. The timber is of moderate hardness, is neither durable nor decorative, and its only known use is for boat masts. However, the good shape and local abundance of the tree suggest that it may in time be of use in plywood manufacture. Both genus and species are described.

12.26-8 (94). SPRAGUE, T. A. A new species of *Rapanea* (Myrsinaceae) from Lord Howe Island. *Proc. Linn. Soc. Lond., 1942-43* 155th Session, Part 3, 1944 (288-90). O.B.D.

The new species, a tree 12-15 m. in height, has been named *Rapanea McCormishii* after its discoverer, Capt. J. D. McCormish. The botanical description is followed by a short note on the most obvious characters distinguishing the new species from *R. platystigma* which (along with *R. myrtilina*) has already been reported from the island.

FUNDAMENTAL NATURAL LAWS OF THE FOREST

13. FOREST ZOOLOGY

13.1. General Zoology

13.15 : 13.2 : 12.21. Woodwasps. *Mon. Sci. News* No. 37, 1944 (4).

A brief outline of the symbiotic relationship between the wood-destroying fungus, *Stereum sanguinolentum*, and female woodwasps of the genus *Sirex* (*S. gigas* and *S. cyaneus*) in Great Britain.

13.15 : 13.2 (74.8) : 34.3 : 12.26-8. BENNETT, L. J., ENGLISH, P. F., and WATTS, R. L. The food habits of the black bear in Pennsylvania. *J. Mammal.* 24, 1943 (25-31). [State College, Pa.] O.R.S.

The range of the black bear (*Euarctos americanus*) includes the Beech/Maple/Hemlock forests of northern Pennsylvania, in which area good stands of Oak (*Quercus montana*, *Q. rubra*, *Q. alba* and others) also occur. Wild cherries (chiefly *Prunus serotina*) and acorns (chiefly *Q. montana*) form a large part of the bear's summer diet, while acorns and beechnuts (*Fagus grandifolia*) are important as autumn and winter foods.

13.15 : 13.2 (78.8) : 12.25. HATT, R. T. The Pine squirrel in Colorado. *J. Mammal.* 24, 1943 (311-45). O.R.S.

The Pine squirrel (*Tamiasciurus fremonti fremonti*) attains its optimum populations in the Lodgepole Pine (*Pinus contorta* var. *murrayana*) forest in the Front Range of Colorado, but it occurs also in other types of coniferous forest. Observations made in the early summer of 1939 showed that its diet at that time was limited to the seeds of the Lodgepole Pine, Limber Pine, Engelmann Spruce, Blue Spruce, Douglas Fir and Alpine Fir, and the staminate flowers of Lodgepole Pine. The bark of Lodgepole Pine is probably used to supplement the diet in winter and early spring, and in dry years fungi may provide an additional source of food. Few instances of injury due to bark removal were observed.

13.15 : 13.2 (79.4) : 12.19 : 12.26-8. HORTON, J. S., and WRIGHT, J. T. The wood rat as an ecological factor in southern California watersheds. *Ecology* 25, 1944 (341-51).

The San Diego wood rat (*Neotoma fuscipes macrotis*) occurs in large numbers in the medium and dense chaparral of the San Gabriel Mountains in southern California. At altitudes below 4,500 ft. the leaves and

twigs of *Quercus dumosa* provide most of the food throughout the year, while above 4,500 ft. considerable quantities of acorns (chiefly *Quercus wislizenii* var. *frutescens*) are stored by the rat for winter use. The activities of this rodent have no appreciable influence upon the vegetation of the chaparral watershed except, possibly, the heavy use of acorns at higher altitudes.

13.15-9 : 13.2 (75.9). MILLER, E. M., and MILLER, D. B. A preliminary study on the distribution and habits of South Florida termites. *Proc. Fla. Acad. Sci.* 6, 1943 (101-7). [Univ. of Miami.] L.S.

13.2. Special [Systematic] Zoology

13.2 (42.1-8) : 12.26-8. SCOTT, H. *Dorytomus rufulus* (Coleoptera, Curculionidae) bred from a hybrid Sallow. *Ent. mon. Mag.* 80, 1944 (206-7).

The author records the breeding of *D. rufulus* Bedel (*pectoralis* Panzer) from larvae fallen from opening catkins on cut twigs of Sallow (*Salix caprea* L. $\times$ *S. aurita* L.) from southwest Buckinghamshire.

13.2 (6) : 13.19 : 31.43. SCHMIDT, H. Tropische Holzbohrkäfer: Bostrychidae. [Tropical wood-boring beetles: Bostrychidae.] *Z. Weltforstwirtschaft.* 10, 1943 (1944), (551-9). [G.e.f.]

The biology of the Bostrychidae and the distribution and economic significance of the more important African species are discussed. The family is distributed throughout the continent as well as in Madagascar, being most heavily represented in Central Africa. Of the seven sub-families of this family, the Dinodoriinae, Lyctinae, and Bostrychinae are found exclusively in tropical Africa.

As yet there is insufficient information on the habits of the different species and their larvae. Most tropical Bostrychidae are nocturnal; all are xylophagous, and attack with preference felled or dead timber. The most widespread damage is done to buildings by the undermining of wooden posts and roof beams. Small wooden objects, e.g. barrel staves, are also destroyed, and the lead casing of electric cables suspended on wooden posts has sometimes been damaged by the insects.

13.2 (75.9). EMERSON, A. E., and MILLER, E. M. A key to the termites of Florida. *Proc. Fla. Acad. Sci.* 6, 1943 (108-9). [Univ. of Chicago.] L.S.

2. SILVICULTURE

2 (73) : 12.19 : 12.25 : 12.26-8 : 32.29.2. CHEYNEY, E. G. *American silvics and silviculture*. University of Minnesota Press, Minneapolis. 1942. pp. x + 472. [University of Minnesota.]

As stated in the Preface, this book attempts to bring together as much information as possible on the factors that influence the growth of trees in competition with each other, on the types into which North American tree species group themselves, and on the silvical characteristics of the more important North American species.

The book is in four parts, the first three of which constitute a textbook on forestry. These deal in detail with:—I. The major and minor silvical factors. II. The topography and forest types of each of the seven forest

regions into which the United States is divided. III. Silviculture, including (a) the factors and concepts fundamental to its practice in North America; (b) silvicultural systems; (c) application of the silvicultural systems to the various forest types; (d) intermediate cuttings; and (e) slash disposal.

Part IV, which is designed primarily for reference purposes, gives silvical descriptions of all the important American species, including for each, such information as is available on range, types and associates; soil, moisture, light, seed production, growth, management, and resistance to damage.

There is a bibliography of 466 references, and a subject and species index.

SILVICULTURE

21. SILVICULTURAL CHARACTERS OF TREE SPECIES

21.1. Light and Temperature Requirements

21.11 : 12.25 : 31.8 : 56. PENSCHUCK. Ein Beitrag zum Thema Kiefern-Wertholzerziehung. [A contribution to the theme of production of high-grade Pine timber.] *Z. ges. Forstw.* 75 [69], 1943 (142-52). [G.]

Notes on the comparative development in early youth of Pine stands grown without overhead cover and under different densities of Oak or Pine canopy. Pines grown under canopy invariably have a lower increment than those grown in the open, while a moderate cover favours the production of high-quality timber.

21.2. Moisture Requirements. Water Régime

21.2 : 12.25-8 (47.6) : 11.49.5 : 56.02 : 11.14.3. ERKIN, G. D. Otnoshenie lesa k urovnyu gruntovykh vod v torfyanyo pochve i k atmosferym osadkam. [The relation of forest to the ground-water level in a peat soil and the atmospheric precipitation.] *Lesnoe Khozyaystvo* No. 5, 1941 (22-4). [Russ.]

From various observations and researches in the Leningrad district and in White Russia during 1928-31, it is suggested that Pine-Birch stands of second and third quality grow best on sedge-covered drained peat soils when the ground-water level during the vegetation period is at an approximate average depth of 30 cm. Under these conditions the current diameter increment seems to depend a great deal on the amount of rainfall during the vegetation period, varying directly with this rainfall.

21.3 Soil Requirements

21.32 : 12.25 : 11.49.2 : 12.11.3. KRUPENIKOV, I. A. Growth of *Pinus* in solonchak soils. *C.R. (Doklady) Acad. Sci. U R S S* 41, 1943 (255-8). [E.] [National Park of Naurzum, Kazakhstan.] C.G.B.

In the forests of the extreme south of Kazakhstan a form of *Pinus sylvestris* has been found to grow well in alkaline solonchak soils in which this species would not normally survive. Investigations are to be made to determine whether or not the new ecotype is likely to be of value in afforesting alkaline soils in other regions.

21.6. Behaviour in the Stand

21.61 : 12.25 (43.1-5) : 12.19 : 56 : 42.32. RUBNER, K. Die praktische Bedeutung unserer Fichtentypen. Ein Vorschlag zur Leistungssteigerung unserer Fichtenbestände. [The practical significance of our Spruce types. A suggestion for increasing the yield of our Spruce stands.] *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 6, 1943 (233-47). [G.]

Report on observations in Germany on the plate type of Spruce (Plattenfichte), in which the branches of the first and the second order are more or less horizontal, and on the comb type of Spruce (Kammfichte), in which the branches of the second order hang down vertically. The former type predominates at high elevations and the latter at medium elevations and in the plain. Where trees of the two types are found close together, those of the comb type tend to have longer needles and show better diameter and height growth. Comb-type Spruce is more resistant to snow pressure, but less resistant to hoar frost and ice deposit than is

the plate-type Spruce. In the plain and at low elevations thinnings should favour trees of the comb type. At higher elevations a mixture of the two types is often advantageous.

21.8. Phenology

21.8. HUBERMAN, M. A. Phenology in forestry. *Chron. bot.* 7, 1943 (403-4). [U.S. Forest Service, Washington, D.C.] O.B.D.

The author refers to some of the material advantages which may be derived (particularly in forestry) from the application of accurate phenological data. Stress is laid on the need for the proper organization of bioclimatic studies, preferably on a national or international basis.

21.8 : 12.26-8 (485) : 21.12 : 12.11.3. SYLVÉN, N. Om ekens lövspricknings- och lövfällningsdata. Ett bidrag till kännedom om ekens mångformighet. [On the dates of coming into leaf and leaf fall in the Oak. A contribution to the knowledge of the diversity of the Oak.] *Svensk PappTidn.* 47 (167-74). P.O.

Further investigations are reported from Sweden on the relation between hardness and early or late autumn colouring and leaf fall; the study has been extended to include observations on the time of coming into leaf. The present detailed report deals with investigations of 480 oaks. Analysis of the results showed:—

Changes in the seasonal type of a particular tree were inconsiderable, only 5 out of 469 specimens exhibiting variable behaviour in coming into leaf and only 10 out of 408 showing variability in the time of leaf fall. There was, however, considerable variation as regards the correspondence between earliness type in the spring and leaf-fall in the autumn. Oaks that are early in spring and late in autumn are, in general, susceptible to autumn frosts and therefore unsuited to northern latitudes, whereas those which are late in spring but early in autumn require a short vegetation period; that these are better adapted to cultivation in northerly regions has been borne out by freezing experiments in spring and autumn at Ekebo. For transfer to northern latitudes trees that are late in coming into leaf but relatively early in assuming autumn colouring and in shedding their leaves seem specially valuable.

M. L. C. W.

22. SILVICULTURAL SYSTEMS. FORMS OF STAND

22.1. High Forest Forms

22.13 (43.1-5). HAUSRATH, H. Zur Geschichte des Schirmschlage. [The history of the shelterwood system.] *Allg. Forst- u. Jagdztg.* 119, 1943 (8-15). [G.]

This account is based mainly on the older German references dealing with the subject.

22.14 (54). LAURIE, M. V. [The efficiency of irregular stocking.] Paper (I). With notes from other sources. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 8, 1941 (175-83).*

22.14 (54.8). WILSON, C. C. [The efficiency of irregular stocking.] Paper (II). *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 8, 1941 (183-6).*

22.14 (54.5) : 12.25. PARKER, R. N. [The efficiency of irregular stocking.] Paper (III). *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 8, 1941 (186-7).*

22.14 (54.5) : 12.25-8. KITCHINGMAN, G. D. [The efficiency of irregular stocking.] Paper (IV). Irregular

stocking with reference to the Galis Forests, Hazara District, N.-W. F. Province. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 8, 1941 (187).*

22.14 (54.2) : 12.25. BAILEY, W. A. [The efficiency of irregular stocking.] Paper (V). *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 8, 1941 (188).*

22.14 (54.2) : 12.26-8. SABHARWAL, L. R. [The efficiency of irregular stocking.] Paper (VI). *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 8, 1941 (188-90).*

22.14 (59.1). KERMODE, C. W. [The efficiency of irregular stocking.] Paper (VII). *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 8, 1941 (190-2).*

22.14 (54.3) : 12.26-8. SAGREIYA, K. P. [The efficiency of irregular stocking.] Paper (VIII). The efficiency of irregular stocking with special reference to the Central Provinces forests. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 8, 1941 (192-5).*

22.14 (54). DAVIS, P. W. [The efficiency of irregular stocking.] Paper (IX). With summary of debate on Item 8. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 8, 1941 (195-200, 200-7).*

M. V. Laurie's paper [cf. *For. Abstr.* 3 (210)] refers to recent European trends towards more natural methods in forest management and recapitulates the arguments of R. Bourne [see *Emp. For. J.* 14, 1935 (215-27)] in favour of irregular systems, with further evidence from other sources. The necessary limitations in applying these theoretical ideas to Indian conditions are discussed, and a plea is made for treating the forest on its merits, avoiding sacrifices of potentially valuable young crops in conversion operations. C. C. Wilson discusses the conservation and conversion of irregularly stocked forests in Madras, agrees with the views in an article of H. G. Champion [see *Emp. For. J.* 14, 1936 (25-8)], and concludes that irregular forests are preferable if the sole object of management is protection of catchment areas; in those forests now worked under a uniform system or in process of conversion to an even-aged condition, however, that policy is the most suitable and profitable. Teak, being intolerant of shade, cannot be grown in irregular forest.

R. N. Parker admits the greater efficiency of irregular stocking in the Punjab Himalayan forests whose principal rôle is protective, but various factors have forced the adoption of a uniform system, and Himalayan coniferous forests are now worked under modified shelterwood and modified selection systems. Text-book rigidity in application has been reduced and the crop is treated according to the slope and nature of the ground, with the aim of making the best use of existing growing stock rather than hoping for a problematic ideal one. [See also *Punjab For. Rec.* I (1), 1936.]

G. D. Kitchingman deals briefly with *Abies spectabilis* and *Pinus excelsa* forests in the North West Frontier Province, where conversion by shelterwood fellings was succeeded by a return to the selection system; in his opinion, however, regular crops are to be preferred for these conifers, except on very steep slopes, because management is simplified and natural regeneration can be obtained. W. A. Bailey considers the arguments against reversion to the selection system are quite conclusive for *Shorea robusta*, Pine and Deodar forests of the United Provinces. L. R. Sabharwal does not favour converting high forest of *Shorea robusta* in Bihar to a completely uniform system of even-aged stands, but would retain pre-existing groups and individual

poles and saplings under 8 in. diameter, and foresees no difficulty in obtaining regeneration from an irregular crop. K. P. Sagreiya reviews the advantages claimed for irregular stocking and discusses the suitability of the opposed systems to forests in the Central Provinces. He concludes that irregular stocking is pre-eminently suitable for the dry Teak forests of the Province in their present inadequately stocked condition; for *Shorea robusta* also, conservative fellings without any attempt at regularity in age or size classes are more desirable than the previous unsatisfactory efforts at conversion to normal stands by clear felling or by the shelterwood compartment system. Mixed forests are best grown as simple coppice or coppice with reserves. P. W. Davis, while admitting that the creation of Teak plantations is justifiable on pre-eminently suitable soils, on account of their high financial value, advocates greater freedom and more opportunism in the management of other forests in Madras, especially on acid and highly leached soils; differing from the majority opinion of Madras foresters, he would maintain some degree of irregularity in the crop and contemplates a long regeneration period of 30-40 years.

C. W. Kermode's paper deals with some aspects of this controversial subject in Burma. Teak-bearing forests are so extensive that total conversion to even-aged forest is out of the question and the greater part of the area must continue to be treated by girdling, extraction, and improvement fellings which may produce more or less even-aged stands here and there. Deciduous Dipterocarp forests could be converted to even-aged stands or maintained naturally as irregular forest.

In debate H. G. Champion disposed of most of the arguments in favour of irregular systems as being impracticable in most Indian forest types. The Conference's final resolution emphasises that the relative advantages of regular and irregular stocking depend largely on local conditions. It recognizes that, under favourable circumstances and with intensive working, uneven-aged stocking may be more efficient than any regular system, especially with shade bearers, but, under present Indian conditions, concentrated regeneration and conversion to more even-aged crops is preferable. Such conversion should be restricted to areas where regeneration, natural or artificial, can be guaranteed, and good immature stock should be retained so that the resultant stand gains some of the advantages of irregular stocking.

22.14.1 (494). FAVRE, E. Fünfzig Jahre Anwendung der Kontrollmethode im Wald von Couvet (Neuenburger Jura). [Fifty years' application of the control method in Couvet Forest (Neuenburger Jura).] *Schweiz. Z. Forstw.* 95, 1944 (142-64). [G.]

22.8. Silvicultural Description of Forms of Stand

22.89 : 12.26-8 : 22.82.1. LAURIE, M. V. [The problem of the pure Teak plantation.] With summary of debate. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 5, 1941 (123-8, 128-32).*

A summary of the conclusions reached on the advantages and disadvantages of pure Teak plantations and of matters needing further investigation. A revised bulletin on the subject has since been published [cf. *For. Abstr.* 4 (165-6)].

SILVICULTURE

22.89 (89) : 12.25 : 12.26-8 : 23.1 : 12.19. SCHNABEL, P. Regeneración natural en los montes de cultivos y puntos sobre naturalización de plantas. [Natural regeneration in plantation woodlands and notes on plant naturalization.] *Maderil* 16 (192), 1944 (11-4). [Span.] A short account of the plantations of Pines (notably *Pinus maritima*) and Eucalypts (notably *Eucalyptus globulus*) at Piriápolis, Uruguay. Both types of plantations have proved a success, and the Pines regenerate freely. The article concludes with notes on plant naturalization, based on E. V. Vulf's 'Introduction to the historical geography of plants', Moscow, 1933.

23. FORMATION OF STANDS

23 (54) : 12.19.2 : 12.26-8. WILSON, C. C. [The regeneration of tropical evergreen forests.] Paper (I). General policy and selection of species. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 6, 1941* (133-4).

23 (54) : 12.19.2 : 12.26-8. GRIFFITH, A. L. [The regeneration of tropical evergreen forests.] Paper (II). Regeneration of tropical evergreen forests. Experimental work in Madras. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 6, 1941* (134-8).

23 (54.8) : 12.19.2 : 12.26-8. LAURIE, M. V. [The regeneration of tropical evergreen forests.] Paper (III). Note on the regeneration of tropical evergreen forests in Coorg. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 6, 1941* (138-40).

23 (54.1) : 12.19.2 : 12.26-8. DE, R. N. [The regeneration of tropical evergreen forests.] Paper (IV). Regeneration of tropical evergreen forests in Assam. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 6, 1941* (140-6).

23 (54.1) : 12.19.2 : 12.26-8. NATH, J. C. [The regeneration of tropical evergreen forests.] Paper (V). A note on the suggested technique for regeneration fellings in the evergreen forests of Kassalong Reserve, Chittagong Hill Tracts Division. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 6, 1941* (147-9).

23 (54.3 : 54.1) : 12.19.2. KRISHNASWAMI, K. [The regeneration of tropical evergreen forests.] Paper (VI). With appendix (including review of paper on 'Regeneration of the Agumbe evergreen forests in Mysore' by P. Krishnaswamy Rao, and 'Note on regeneration of evergreen forests in the Andamans' by B. S. Chengappa) and summary of debate on Item 6. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 6, 1941* (149-53, 153-7).

The general policy in Madras, according to C. C. Wilson, aims at encouraging the production of species now in demand by natural regeneration in gaps; experiments are in progress with species likely to be wanted in future and artificial regeneration is prescribed on an experimental scale only. In the second paper A. L. Griffith gives details of experimental work in Madras, where evergreen forests are divided for this purpose into 3 types, (a) with a rainfall of over 150 in. per annum, and (b) with a rainfall of 70 to 150 in. per annum, and (c) forests in the 70- to 110-in. rainfall area degraded to moist mixed deciduous. Natural regeneration has been studied in types (a) and (b) with the conclusion that best results are obtained from working by selection fellings, allowing the gaps to be restocked naturally, and tending such natural regeneration of good species when present in sufficient quantity to be economically worth tending. About half-a-dozen of the valuable evergreens can be artificially regenerated in types (a)

and (b) by raising concentrated plantations under a shelterwood, better results being obtained by transplanting than by sowing or stumping; burning is not necessary and weeding is beneficial. In type (c) natural regeneration is uneconomic and clear felling and burning is the rule, with a tendency to replace with semi-evergreen rather than deciduous species.

M. V. Laurie deals with tropical evergreen forests in Coorg, which generally contain much regeneration of *Valeria indica*, *Dipterocarpus indicus* and other valuable species; here the main problem is regulation of fellings so as to get the existing regeneration up successfully and to supplement it. Where there is a preponderance of the higher girth classes in the overwood an irregular shelterwood system is used; where distribution is fairly normal a selection system is adopted with a 6-ft. girth limit for main fellings. In both cases main fellings are followed by improvement fellings to eliminate inferior species. Details are given of measures for inducing additional recruitment and tending.

R. N. De discusses the various classifications proposed for types of evergreen forest in Assam and gives a historical account of experiments in natural and artificial regeneration. The general policy is one of compensatory plantation by which a large block of worked forest is artificially regenerated with marketable evergreen species by plantations or *taungyas*.

J. C. Nath states that in Bengal the policy is to clear-fell tropical evergreens and to restock artificially by *taungya*, mainly to supply the plywood industry. His paper includes suggestions for regeneration technique in the Chittagong Hill Tracts which aims at freeing and establishing desirable advance growth.

K. Krishnaswami's paper compares the influence of ecological factors on the seedling regeneration in evergreen and deciduous forests with special reference to the demand for light and the competition for space, and points out that in Mysore, evergreen forests are far easier to regenerate naturally than are deciduous forests. Notes on the history of regeneration operations in Agumbe State forest are appended.

The evergreen forests of the Andamans are dealt with by B. S. Chengappa. In the wet deciduous type with evergreen undergrowth, it has been found that the canopy should be completely removed within 10-12 months of completing exploitation fellings. In the true evergreen areas new recruitment from seed cannot be relied on in the year of exploitation, but where regeneration is already on the ground, brushwood fellings remove useless species a few years before the main felling, and the canopy can be opened up subsequently almost as rapidly as in the deciduous type. These conditions are different from those in the rest of India, where slow opening is necessary.

23.1. Natural Regeneration

23.1 : 12.25 : 12.26-8 : 21 : 12.11.3. KOROLEFF, A. The need of adequate basis for control of forest regeneration. *For. Chron.* 20, 1944 (188-91).

The natural regeneration of felled areas depends largely upon the conditions brought about by logging and the inherent characteristics of the tree species concerned. In order to forecast how different forest species will react to a given form of cutting it is necessary to know as much as possible about the requirements of each species in relation to such basic ecological

factors as light, water and temperature. These requirements vary throughout the life of a tree from seed germination to maturity, and it is particularly desirable that information should be obtained on the germination and seedling stages. With this end in view the author sent to a number of foresters a questionnaire on the optimum silvicultural requirements (soil moisture, light, and local climate) of selected species at five stages in their development (germination, seedling, sapling, pole, standard). The average data thus obtained is condensed into a table showing the believed requirements of White Spruce, Black Spruce, Balsam Fir, Jack Pine, White Birch and Poplar. The need for further systematic research is emphasized.

23.1 : 12.26-8 (485) : 12.19 : 24.36. WELANDER, P. O. Rönnsens förekomst och reproduktion i granskogar inom det norrländska inlandet. [The occurrence and reproduction of Mountain Ash in Spruce forests in the interior of Norrland.] *Svensk bot. Tidskr.* 38, 1944 (185-6). [Sw.]

Mountain Ash (*Sorbus aucuparia*) is widely distributed in the Birch and Pine forest regions of Norrland; in the interior it is confined mainly to clearings (particularly in Spruce stands) where it frequently occurs in large numbers. The fact that luxuriant regeneration is often found in districts where there are no fruit-bearing Mountain Ash trees suggests that the young plants were probably present in the stand prior to cutting. Investigations have shown the presence of many such plants growing from root fibres in the upper soil layer; frequently they are so small that their leaves scarcely reach above the moss cover. Vigorous development of these plants follows the clear cutting of the Spruce.

23.1-2 (54) : 24.36. KERMODE, C. W. D. 'Natural regeneration without seedbearers'. *Indian For.* 70, 1944 (289-96 + plate).

The author discusses a technique for natural regeneration which has been employed in certain types of forests in Burma with great promise of success. It concerns the reproduction of miscellaneous species in areas (*taungya* and otherwise) which have been cleared and burned. A great deal of unnoticed natural generation of Teak and other species is usually present in these burned-over areas and will develop when the canopy is opened up. By regarding an area as completely stocked if it contains one Teak plant (or other valuable species) per 6 ft. x 6 ft. square, the author shows that the stocking of certain areas regenerated in this way compares very favourably with plantation stocking. Most of the regeneration is derived from root stocks that have not previously produced a tree even of sapling size, but seedlings and sprouts from stools are also present. If necessary, stumps or seeds may be used to fill gaps in the natural stocking. The valuable species should be present in something like final crop or half final crop spacing and will grow to maturity in a matrix of natural forest. Thinning operations will remove less valuable species for fuel and posts.

Research is still required on the amount of regeneration that should be present before a *taungya* fire in order to give an adequate crop after burning, on the age at which it is safe to cut and burn *Xylia* seedlings, and on crops suitable for poor quality soils to which it is wished to attract *taungya* cutters.

23.13 : 12.25 : 21.11 : 21.3 : 45.3 : 22.11. LEBARRON,

R. K. Influence of controllable environmental conditions on regeneration of Jack Pine and Black Spruce. *J. agric. Res.* 68, 1944 (97-119). [Lake States Forest Exp. Sta.] O.R.E.

A study was made of the effect on the natural regeneration of Jack Pine (*Pinus banksiana*) and Black Spruce (*Picea mariana*) of the four environmental factors considered to be most important in this regard: (1) density of tree cover, (2) density of lower ground cover, (3) character of soil surface, and (4) seed-destroying rodents and birds. The results indicate that both species respond in much the same way to these factors, although Jack Pine seedlings, being larger and faster growing, have a somewhat better chance of survival and establishment.

Bare mineral soil was found to be the best germination medium of those tested, although seedling growth was not as rapid on mineral soil as on other types of surface material. The establishment and growth of seedlings during summers not seriously deficient in rainfall was favoured by the absence of both tree and lower vegetation cover. Insects were found to be the chief cause of early mortality, damage being particularly serious on scarified and shaded duff and on undisturbed duff.

From this study it appears that the conditions most favourable to the establishment and growth of reproduction of these species will be created by tearing up the ground surface to expose the mineral soil and by clear cutting the timber, the establishment of reproduction to follow cutting promptly in order to avoid competition from invading vegetation.

23.2. Artificial Regeneration

23.2 : 12.26-8 : 21 : 12.11.21-2 : 11.62.31. MIRON, K. F. Kul'tura topoley. [The growing of Poplars.] *Trud. vses. nauchno-issledov. Inst. lesnogo Khoz. 'VNIILKH'* No. 3, 1939. pp. 56 + maps. [Russ.]

A manual providing detailed practical information on the artificial propagation of Poplars based on investigations carried out by Russian Scientific Institutes in Forest Management and on other published and unpublished material.

The manual is intended primarily for use in the zone of water-conservation forests, where the objects of Poplar research work are to increase the species and varieties under cultivation, to ascertain their suitability for the different sub-zones, and to devise methods of growing Poplars in mixture with other trees and shrubs. The following species are considered to be suitable for large-scale planting in the zone: *Populus alba* L., *P. bachofenii* Wierzb., *P. hybrida* M.B., *P. tremula* L., *P. nigra* L., the Lombardy Poplar, *P. canadensis* Mch., *P. laurifolia* Ledeb., *P. balsamifera* L., *P. simonii* Carr., and *P. berolinensis* Dipp.

The biological features, ecological character and technical qualities of these species are described, and recommendations made for their use in the various sub-zones. Methods of vegetative propagation in special parent-stock 'plantations' or nurseries for the supply of rooted cuttings from stool or pollard shoots are given in detail. The preparation, collection and storage of Poplar stem cuttings before lining out are described, with notes on the quality of those cut from various ages and parts of shoots. The technique and equipment necessary for the propagation of Poplars from green summer cuttings are described.

The collection, preparation, cleaning and storage of Poplar and Aspen seed is dealt with, and the technique of sowing and handling seedlings in the nursery, together with notes on a number of pests and diseases, is given in detail.

The best method of planting Poplars for soil protection and water conservation purposes is discussed and three types of plantations are recommended, to be used according to local requirements. Two of these types involve mixtures of Poplars with other trees and shrubs, such as Norway Spruce, Linden, Hornbeam, wild apple, wild pear, Field and Tatarian Maples, Hazel, guelder rose, *Euonymus* and currants. Great stress is placed on working the soil both before and after planting, and brief notes are supplied on the kind of planting material recommended and its treatment.

23.21. Choice of Species

23.21 : 12.26-8 : 21 : 23.24 : 45.3 : 33.54. COPE, J. A. Black Locust for posts. *Ext. Bull. Cornell Univ.* No. 539, 1942. pp. 23.

Following a brief account of the range, distribution and characteristics of Black Locust (*Robinia pseudo-acacia*), and of damage caused by the Locust borer (*Cyllene robiniae*), notes are given on source of planting stock; establishment of plantations, including site requirements and preparation, associate species in mixed plantings, and spacing; care of plantation; and harvesting.

23.21 (42.1-8) : 12.25 : 23.3. EDLIN, H. L. Wild Pines of southern England. *Scot. For. J.* 58, 1944 (58-63).

Scots, Maritime, Corsican and Monterey Pines have all succeeded in establishing themselves naturally on the very unfavourable heath soils in certain parts of southern England, and it is suggested that these species should be of value in the afforestation of difficult soils.

23.21 (68.1) : 12.25 : 12.26-8 : 42.21. BECHUANALAND. Annual report, Forest Department, for year ending 31st December, 1943. [Forest Department, Bechuanaland.] 1944. pp. 3.

Of the exotic species that have been tested in plantation (under conditions of low rainfall and on a red sandy loam poor in organic matter), *Eucalyptus camaldulensis* (= *E. rostrata*), *E. paniculata* and *E. saligna* have done best so far, and *Casuarina cunninghamiana* and *Callitris glauca* are promising. The following species have been damaged by frost: *E. citriodora*, *Acacia saligna*, *Cassia siamea*, *C. auriculata* and *Syncarpia laurifolia* (p. 1).

Rooted cuttings of *Populus deltoides* have been successfully established on a clay silt of good humus content overlying a moist sand, and it is believed that matchwood timber can be grown on this site (p. 1).

Indigenous species that have produced sturdy transplants are the timber tree *Spirostachys africana*, the Wild Olive (*Olea africana*) and the hedge plant *Gardenia spatulifolia* (p. 2).

23.21 (68.9) : 12.25-8 : 23.27 : 12.11.21-2. BARNES, J. W. Some trees, shrubs, shrubby-herbaceous plants, climbers and water plants suitable for the colony. *Repr. from Rhod. agric. J.* 41, 1944 (1-31). [Govt. Forest Nursery, Salisbury.]

This comprehensive list of trees and other plants is designed mainly for readers interested in horticulture or landscape gardening in Rhodesia, but it is also of value in connexion with forest tree planting. Short advisory

notes are given on the planting and cultivation of hedges and of avenue or street trees, on methods of propagation, and on raising plants from cuttings. The main part of the bulletin is divided into four sections: (1) trees, (2) shrubs, (3) climbers and creepers, (4) palms, bamboos, etc. A brief description is given for each plant in the list, and the recommended method of propagation (seeds or cuttings) is indicated in each case.

23.21 (729.5) : 12.26-8 : 23.24 : 11.62.11. WADSWORTH, F. H. The development of a Maria plantation on a poor site. *Carib. For.* 5, 1944 (207-12). [Espan.] [Tropical Forest Exp. Sta., Rio Piedras, Puerto Rico.]

Calophyllum brasiliense var. *antillanum* has been widely planted in recent years in the public forests of Puerto Rico. Its wood is valued for construction and other purposes, but its chief advantage is that it can be established by direct sowing on the most unfavourable sites.

In 1944 5 small plots were established in an 18-year-old plantation of this species on a heavily eroded site to determine the growth rate and nature of forests developed from Maria seedlings. While growth has not been rapid, the plantation has proved of great value in site restoration. On similar sites initial spacing should be close and thinnings should begin at an early age: thus a canopy will be formed quickly, and adequate growing space will be provided as the plantation develops.

23.22. Preparatory Work. Auxiliary Measures

23.22.1 : 23.61 : 12.26-8. UNITED STATES. Annual report of the Allegheny Forest Experiment Station. Philadelphia, Pa. [1944.] pp. [34].

In an experiment undertaken to determine the best method of establishing Poplars on grassland, three methods of treatment were used: (1) sod removed from planting site; (2) sod removed and soil dug to depth of 8 in.; (3) sod turned into ground to depth of 8 in. By far the best results in survival and height growth were obtained by method (3) followed by weeding during the first year (pp. 16-7).

23.22.1 : 23.13. WENNMARK, G. Kloratbehandling av skogsmark. Ett medel att underlätta skogsodling och självsådd. [Chlorate treatment of forest land. A means of facilitating forest tree planting and natural regeneration.] *Skogen* 31, 1944 (141-3). [Sw.]

Best results in clearing the planting site of heather and scrub were obtained by dusting with chlorate in the autumn. In general, an application of 40 kg. of chlorate per ha. is recommended for killing heather.

When moderate amounts of chlorate have been applied in the autumn, sowing or planting can usually take place the following spring, particularly if the more readily soluble sodium chlorate has been used. Treatment with chlorate encourages natural regeneration and appears to result in increased growth.

23.23. Sowings

23.23-4 : 12.26-8 (485) : 24.1. BÅNG, F. Eken—ett värdefullt trädslag. Några praktiska anvisningar för ekskogsodling. [The Oak—a valuable tree species. Some practical directions for the establishment of Oak forest.] *Skogen* 30, 1943 (215-7). [Sw.]

Oak (*Quercus pedunculata* and *Q. sessiliflora*) is best planted in relatively open situations, immediately after felling and before grass has become established.

SILVICULTURE

Direct sowing has been successful where the soil is not grass-bound. More seed per unit area should be used for autumn sowings than spring sowings, as the former appear to be more subject to attack by rodents and birds; spring sowings should be made not later than the beginning of April.

For winter storage acorns should be kept in a cool, frost-free place, in fairly shallow layers, and should be turned over occasionally; they should be examined carefully before sowing.

Beech is a useful species to plant in mixture with Oak. Birch, Aspen and Sallow, which frequently become established in Oak plantations, assist in stand closure, but may check the growth of the Oak if not controlled; light cleanings repeated frequently give best results.

23.23.1. Seed Procurement, Treatment, and Testing

23.23.11 : 12.25. ROSENKRANS, D. B. *Slash Pine produces viable seed north of its natural range.* *J. For.* 42, 1944 (685). [Clemson College.]

Slash Pine (*Pinus caribaea*) planted in 1925 and 1927 in northwestern South Carolina, about 140 miles from its natural range, produced seed in 1943 that showed fairly good germination; it is believed that natural regeneration of the species will be possible in this region.

23.23.15 : 12.25 : 23.23.19. MIROV, N. T. Possible relation of linolenic acid to the longevity and germination of Pine seed. *Nature, Lond.* 154, 1944 (218-9). [U.S. Forest Service.]

Seeds of Jeffrey Pine (*Pinus jeffreyi*) store well in airtight jars at room temperature and germinate rapidly and abundantly under normal greenhouse conditions, whereas seeds of Sugar Pine (*Pinus lambertiana*) are short-lived and give a very small percentage of germination unless they have previously been chilled in some moist medium for three months at 5° C., in which case they germinate as well as those of Jeffrey Pine. Analyses of the oil present in the seed of the two Pines have shown that there is a higher degree of unsaturation in the seed oil of Sugar Pine. In ordinary storage the most unsaturated component of the oil—linolenic acid—disappeared gradually in all seeds, but more rapidly in Sugar Pine than in Jeffrey Pine seed, whereas in seeds of both species stored at 5° C. no appreciable losses in linolenic acid were observed. Storage of Sugar Pine seed in moist sand at 5° C., however, resulted in the disappearance of most of the linolenic acid after three months, a phenomenon possibly connected with the first stages of germination and the utilization of stored food materials.

23.23.15 : 12.25-8. DYACHENKO, A. E. *Znachenie stratifikatsii semyan nekotorykh drevesnykh porod. [The importance of stratification of seed for certain tree species.] [Trud.] vses. nauchno-issledov. Inst. Agrolsomal.* No. 12, 1940 (108-24). [Russ.russ.]

Seed stratification is important for ensuring proper seed germination and seedling development of certain species, and also has many beneficial effects for species whose seeds are not usually expected to require such treatment. These benefits include:—(1) an increase in nursery germination; (2) an increase in the speed and vigour of seedling development; (3) an increase in the out-turn of nursery stock; (4) a hastening of the termination of the growing period of the seedlings of some species.

For the species dealt with in this bulletin the temperature recommended in all cases is 0° to 8° C., preferably nearer 0°, and the periods of stratification recommended are as follows:—

Species	Period of stratification
<i>Picea pungens</i>	1 month
<i>P. sitchensis</i>	30-35 days
<i>Pseudotsuga taxifolia</i> (all varieties)	30-25 days
<i>Pinus strobus</i>	1½-2 months
<i>P. ponderosa</i>	30-40 days
<i>P. rigida</i>	1 month
<i>P. murrayana</i>	30-45 days
<i>P. peuce</i>	not less than 3 months
<i>Larix dahurica</i>	20-30 days
<i>Acer saccharum</i>	60-70 days
<i>A. negundo</i>	25-30 days
<i>Fraxinus lanceolata</i>	1 month
<i>F. pennsylvanica</i>	30-35 days
<i>Betula lenta</i>	2 months
<i>B. papyrifera</i>	

23.23.19 : 07.7. GINDEL, J. A simple forest seed germinator. *Emp. For. J.* 23, 1944 (74-5). [Agricultural Research Station, Rehovot.]

The construction of this germinator aims at approximating natural conditions. Boxes 10 × 15 × 25 cm., made of sand and loam in a proportion permitting moderate permeability, are filled with sterilized sand or other soil which is pressed down to increase capillarity. Small seeds are placed on the surface and large seeds are pressed partly into the sand. To increase humidity the seeds are covered by cups equipped with small holes. The boxes are placed in a bath filled with water to a level regulated according to conditions of the testing season.

23.23.3. Methods of Sowing

23.23.3 (47.6) : 12.25. OLERINSKIY, V. YA. *Resul'taty chetyrekhletney raboty po aerosevu. [The results of four years' work with sowing from the aeroplane.] Lesnoe Khozyaystvo* No. 4, 1941 (53-7). [Russ.]

An account of experience in the Ryazan region where, during the period 1937-40, 4,556 ha. of clear-cut, largely burnt-over, Pine land was sown with 8,240 kg. of Pine seed by aeroplane. Part of the area was prepared by ploughing, cultivation, etc., but this was unnecessary where moisture conditions were satisfactory.

On most sites aerial sowing was successful. The operation was carried out so that a strip 18 m. wide was sown at a time. The density of the Pine was subsequently found to be greatest in the central portions of the strips and decreased towards the margins; there were some blanks due to irregularities in the line of flight. Under prevailing conditions broadleaved species, notably Birch, become established naturally in large numbers on these sites and tend to dominate areas on which the Pine is scattered.

The total cost of crop establishment by this method was less than half of that for the usual method of sowing; in addition, the method is quick and labour-saving. One of the chief drawbacks of aerial sowing is that it involves a great waste of seed, only 4-6 per cent. of the seed sown being effective.

23.24. Formation of Stands by Planting

23.24 : 12.26-8 : 56.01 : 21.61. BURGER, H. Essais comparatifs de plantation de chênes dans la forêt communale de Gunzgen, canton de Soleure. [Comparative trials in Oak planting in the communal forest of Gunzgen, Canton of Soleure.] *J. for. suisse* 95, 1944 (177-84). [F.] [Institut Fédéral de Recherches Forestières.]

Experimental plantations of one- and two-year seedlings of Pedunculate and Sessile Oak were established in 1916-17. In early life better height growth was shown by Pedunculate Oak in comparison with Sessile Oak and by one-year seedlings in comparison with two-year seedlings (presumably because the latter had been planted on sites bearing relatively more weeds); by 1940 all these differences in height growth had disappeared. In all cases a high proportion of stems were of poor shape, though Pedunculate Oak was somewhat better than Sessile Oak in this respect.

23.24 : 23.21 : 64. MINCKLER, L. S. Early results from a reforestation 'pilot plant'. *J. For.* 42, 1944 (586-90). [Appalachian Forest Exp. Sta., Asheville, N.C.]

Based on the results of reforestation experiments established in 1938 to determine the relationship of species adaptation to site, planting specifications were prepared with reference to soil characteristics, topography, and vegetation [cf. *J. For.* 39, 1941 (685-8)]. In 1940 a 'pilot plant' of 722 plantable acres was selected, the specifications being used as a guide to the species or mixtures of species to be planted on different portions of the area. A sampling of 31 of the 103 plantations, made 3 years after establishment, shows that growth and density of stocking are satisfactory.

23.24 : 12.26-8 (54.87) : 21.1-3. PARSONS, T. H. Progress of Balsa cultivation in Ceylon. *Trop. Agriculturist, Ceylon* 99, 1943 (214-7). [Royal Botanic Gardens, Peradeniya.] O.R.E.

Interest in Balsa cultivation in Ceylon has been stimulated by the Australian demand for this timber. First-quality wood can be produced in Ceylon provided the tree is grown under suitable conditions, which include ample moisture, a loose, friable soil, and an elevation of less than 2,000 ft. The percentage of seed germination is generally poor, being seldom more than 15 per cent. and often as low as 5 per cent., but growth is usually rapid when healthy seedlings have once been planted out and have formed their rough leaves. Spraying with an insecticide to protect the seedlings from insect attack during the first month or 6 weeks after planting is recommended. The most economical spacing appears to be 12 × 15 ft.

Data from two experimental plots indicate that material of the required dimensions can be obtained in 5 or 6 years from trees grown in garden river-bank soils of poor humus content.

23.24 (76.4 : 78.9 : 79.1 : 79.4) : 11.62.11 : 23.21. WILSON, R. E. Tree planting and soil erosion control in the southwest. *J. For.* 42, 1944 (668-73).

This article discusses the purposes, difficulties, and results of tree planting in the southwestern United States, with special reference to erosion control.

Most of the work undertaken has been concerned with river-bank protection, stream desilting, and wind-breaks. The most important factors that tend to limit the survival of plantations are grazing, drought, and flash floods.

The native 'Cottonwoods' (*Populus* spp.), Willows (*Salix* spp.) and Russian Olive (*Eleagnus angustifolia*) have been the most satisfactory for planting under the severe conditions characteristic of this region. The evergreen Tamarisk (*Tamarix articulata*) grows rapidly and is of great promise wherever water supplies are adequate.

23.24 : 07.7 : 23.27. Tree-hole digger. *Amer. Nurseryman*. 80 (3), 1944 (5).

Description of a labour-saving device for digging tree holes and post holes, making use of a Ford tractor with Ferguson hydraulic system. Reference is also made to a trailer cart for spraying the lower branches of orchard trees.

23.24.1. Planting Material

23.24.1 : 07.7. Tree seedling package. *Amer. Nurseryman*. 80 (3), 1944 (5-6).

Description of a new method of packaging forest tree seedlings, using interwoven veneer mats, bale tie wire, and moist sphagnum moss. The advantages and disadvantages of the method are enumerated.

23.24.2. Methods of Planting

23.24.2 : 24.2. SAGRETYA, K. P. Triangular square planting. *Indian For.* 70, 1944 (283-9).

It is suggested that triangular planting results in a tree distribution more like that obtained under natural conditions than does square planting, and is therefore to be preferred from the physiological point of view. The contention that it is more difficult and expensive to fix plant positions for triangular planting is not supported by factual evidence; a simple method is described which compares favourably with the usual methods employed in square planting. Triangular planting has the advantage over square planting that mechanical thinnings of the crops can be carried out to various intensities in such a way that the plants retained have equal freedom to grow on at least two sides. The steps in thinning triangular plantings to various intensities are illustrated diagrammatically.

23.26. Plant Rearing. Nursery Practice

23.26.3 : 21.64. UNITED STATES. Annual report of the Allegheny Forest Experiment Station, 1943. Philadelphia, Pa. [1944.] pp. [34].

Primary requisites for successful bare-root transplanting of trees during the growing season are given as: (1) adequate protection of roots against drying; (2) proper planting, i.e. packing the soil about the roots and settling it with water; (3) heavy top pruning of hardwoods; (4) supplementary watering during first year if rain is inadequate. Liberal application of fertilizers during the dormant period before lifting will favour increased survival (p. 22).

23.26.4 : 11.47.1 : 42.22. UNITED STATES. Annual report of the Allegheny Forest Experiment Station, 1943. Philadelphia, Pa. [1944.] pp. [34].

A new technique in the fertilizing of forest nursery stock has been found to increase field survival during drought years by as much as 20 per cent. Resistance is increased by restricting the amount of nitrogen and maintaining a proper balance between nitrogen, phosphorus and potassium during the growing period, and by applying large amounts of fertilizer during the dormant period 1-5 months before lifting for planting in the field (pp. 20-1).

23.27. Arboriculture

23.27 : 44.3 : 42 : 45.3 : 24.51 : 23.21 : 23.26.3. FENSKA, R. R. *Tree experts manual*. A. T. De La Mare Company, Inc., New York, N.Y. 1943. pp. 192. Price \$4.50.

A manual on the care of shade and ornamental trees. Subjects covered include the watering of trees, the use of fertilizers, transplanting, pruning, dressing of tree wounds, bracing and cabling, lightning protection for trees, tree surgery, tree diseases, damage due to unfavourable environment, insects and their control, selections of tree species for different purposes, and American legislation relevant to shade trees.

23.27 : 23.21 : 23.24 : 24. Fox, W. *Roadside planting (including post-war suggestions)*. *J. R. hort. Soc.* 69, 1944 (231-9). O.B.D.

Arguments are given in favour of the use of suitable exotic tree species for roadside planting. As a rule, it is advisable to keep the trees on the side verges to one variety for each section or natural division of the road. The space allotted to tree planting on modern roads is so narrow that there is seldom room for staggering or mass grouping of species. Some general advice is included on planting, after-care and pruning, as well as on the choice of suitable shrubs and trees for main roads, central strips between carriageways, and island roundabouts.

23.3. Afforestation

23.3 : 23.21 : 4. JUNGO. *Les difficultés des reboisements en montagne*. [The difficulties of mountain reforestation.] *J. for. suisse* 95, 1944 (60-5). [F.]

In mountain regions afforestation presents special difficulties. Many failures in the past have been due to lack of knowledge of the principles of plant sociology, the relation between species and site, seed provenance, and soil drainage. When planting is to be undertaken on mountain sites, due regard must be paid to factors such as landslides and soil erosion, the water régime, the action of wind, hail, snow and ice, and fungus and insect pests.

Fundamental principles in the technique of afforestation include: (1) proper preparation of the site by means of drainage, aeration, and breaking up of the soil; (2) strict observation of the rules of natural succession; (3) the use of seed adapted to the site; and (4) the arrangement and structure of the stand with a view to affording protection against inclement weather conditions. The more closely these principles are observed, and the more nearly the plantations are in accordance with nature, the greater will be the natural resistance of the trees to pests and disease.

23.3 : 91.3. SISAM, J. W. B., and WHYTE, R. O. *Establishment of vegetation on coal tips and other spoil mounds*. *Nature, Lond.* 154, 1944 (506-8).

Methods are suggested for the establishment of vegetation on waste tips and mounds, in accordance with ecological principles. In the first instance it is necessary to decide the general aim of reclamation—whether for amenity purposes or for yielding an economic return. Thereafter care must be taken in choosing the species of trees, shrubs, herbage or other plants best adapted to the rather abnormal environment, taking into consideration factors such as the degree of weathering of the spoil material, its nutrient or toxic qualities, soil moisture and drainage conditions, surface temperature, and degree of erosion and soil-

wash. Consideration must also be given to the problem of air impurities in districts still in active production.

In many cases tree planting is the method adopted for spoil-mound reclamation. Old, well-weathered mounds generally offer little difficulty in tree establishment, but on poorer sites, where the material is largely unweathered and sterile, it is important that the humus content and moisture-retaining capacity of the soil should be improved as quickly as possible. Pioneer species such as Willow, Birch, Poplar, and Alder are particularly suitable for such sites. As soil conditions improve, more exacting species of higher economic value may be introduced. Corsican Pine is particularly recommended, as it stands up to smoky conditions and does well on a low rainfall. Other species used with success in spoil-mound reclamation in Great Britain (in addition to the four pioneer species already noted) are Mountain Ash, Elder, Wild Cherry, Wych Elm, Hawthorn, Laburnum, Sycamore, Ash, Austrian Pine, Scots Pine, European Larch, Sitka Spruce, and London Plane.

23.3 (410) : 60.31.2. GUILLEBAUD, W. H. *Treatment of felled or devastated farm woodlands*. *Agriculture (J. Minist. Agric., Lond.)* 50, 1943 (561-5). [H.M. Forestry Commission.] O.R.S.

Before replanting or filling gaps in felled or devastated farm woodlands, it is necessary to decide for what purpose the trees are to be used—whether in the production of stakes and poles or of high quality timber, or in the provision of shelter for livestock. The author describes some of the main types of British woodland and discusses the kind of problem that arises when replanting becomes necessary. Sections are included on the treatment of felled coppice, coppice-with-standards, and coniferous woods, and the replanting of felled broad-leaved high forest.

23.3 (47.3). MAYER-WEGELIN, H. *Die geschichtliche Entwicklung der Aufforstungen in der ukrainischen Steppe*. [The historical development of afforestation in the Ukrainian steppes.] *Forstarchiv* 19, 1943 (95-107). [G.]

23.3 (51) : 11.62.31 : 23.21 : 12.25 : 12.26-8. ESCHENLOHR. *Das deutsche Aufforstungswerk in Tsingtau*. [The German afforestation work in Tsingtau.] *Z. Weltforstwirtschaft* 10, 1943 (1944), (543-51). [G.e.f.]

A note on the afforestation and river-training work carried out during the 15-year period of German administration. Species used successfully included Chinese Poplars, species of Alder, *Pinus thunbergii*, and, in particular, *Robinia pseudoacacia*, which was introduced from Germany. This species proved very suitable for mining timbers and sleepers, and it was subsequently planted extensively throughout China.

23.3 (54.2) : 12.26-8 : 11.62.11 : 91.7. DAVIS, D. *Note on the work of the Forest Development Division, United Provinces*. *Indian For.* 69, 1943 (457-60). [Working Plans Circle, U.P.]

A review of progress in the creation of village plantations in the United Provinces since 1938. The first plantations were established on land belonging to zamindars in the Meerut, Rohilkhand and Lucknow civil divisions. Efforts to persuade tenant cultivators to give up part of their land for plantations were not successful in this area, but in 1939, when work was

extended to Fyzabad civil division, nearly a third of the new plantations consisted of plots belonging to tenant cultivators. Since the co-operation of the villagers is essential for the success of the forest development scheme (which aims chiefly at erosion control and the production of fuel, timber and fodder for the use of the villagers) and since the zamindars, who own most of the waste lands, generally refuse to allow their land to be managed by village *panchayats*, it is recommended that the Government should acquire land for the establishment of plantations to be managed by the villagers themselves.

In spite of various difficulties, including unfavourable weather, a useful beginning has been made in the work of afforestation. The total area under successful plantations is only 3,850 acres, but it represents over 1,000 different plots scattered over hundreds of villages. Some of the plantations are already yielding fair quantities of fuel from thinnings. The main species used in these village plantations have been *Acacia arabica* and *Dalbergia sissoo*, but other trees such as *Acacia catechu*, *Azadirachta indica* and *Eugenia jambolana* have been planted in varying quantities.

23.3 (54.8-9) : 11.62.11. PHADKE, A. B. Afforestation experiment under the Gradoni system in Poona Division. *Indian For.* 70, 1944 (183-7).

The author describes the procedure and aims of the Gradoni system of terracing and gives two examples of schemes of afforestation based on this system—that of the Khed arid area started four years ago, and the Khardpudi Bk. Land Development Scheme, at present in its early stages. Tree species being used in these schemes include: *Gmelina arborea*, *Acacia catechu*, *Dolichandrone falcata*, *Albizia amara*, *A. lebbeck*, *A. procera*, *Azadirachta indica*, *Cassia siamea*, *C. auriculata*, *Pongamia glabra*, and *Zizyphus jujuba*.

23.3 (82). CARMELICH, J. N. F. Planes de reforestación de la Dirección Forestal. [Reforestation plans of the Forest Administration.] *Maderil* 16 (191), 1944 (15-6, 27). [Span.]

A note on the organization and plans of the Reforestation and Afforestation Section of the Argentinian Forestry Division.

23.5. Underplanting. Shelterwoods. Nurses. Filling Gaps

23.51 (485) : 12.26-8 : 12.25 : 63. PETRINI, S. Eksamogen och granunderväxten. [The Oak forest and Spruce undergrowth.] *Skogen* 30, 1943 (321-2). [Sw.] 23.51 (485) : 12.26-8 : 12.25. SÖKJER-PETERSEN, E. Underväxten i eksamogen. [The undergrowth in Oak forests.] *Skogen* 30, 1943 (347-8). [Sw.]

On the basis of experiments carried out in Oak forests in Visingsö, forest management is now directed to the continued use of a Spruce understorey in these stands. As soon as the Oak is thinned sufficiently, all material other than Oak is removed and underplanting with Spruce is carried out. The Spruce is thinned as required for the proper development of the Oak. Two crops of Spruce are obtained during a single rotation of Oak of 160-180 years. In the second article it is pointed out that while yield of Oak on the areas studied was only slightly influenced by the understorey, it would not be safe to assume that this would be true

elsewhere, having regard to the length of the Oak rotation in comparison with the period of investigation.

R. P. J.

23.53 (54) : 22.14.1. LAURIE, M. V. [Artificial regeneration with selection methods of working.] Paper (I). *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 7, 1941 (159-61).*

23.53 (54) : 22.14.1. GRIFFITH, A. L. [Artificial regeneration with selection methods of working.] Paper (II). Notes on gap regeneration with the selection method of exploitation. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 7, 1941 (161-6).*

23.53 (54.1) : 22.14.1. MACKARNES, C. G. M. [Artificial regeneration with selection methods of working.] Paper (III). *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 7, 1941 (166-7).*

23.53 (54.8) : 22.14.1. KRISHNASWAMI, K. [Artificial regeneration with selection methods of working.] Paper (IV). With summary of debate on Item 7. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 7, 1941 (167-9, 170-4).*

M. V. Laurie's paper summarizes the opinions of provincial forest departments on the management by selection methods of irregular forests deficient in natural regeneration, and points out the limitations in the application of the principle of compensatory plantations. In the Bombay selection forests, compensatory plantations are the general rule and gap regeneration is not used. The present policy in Coorg relies entirely on plantations to replace timber removed in selection fellings. Similar principles are applied in the United Provinces in forests of *Shorea robusta* and *Acacia catechu*. Experience of gap regeneration in evergreen and mixed deciduous forests in Madras is recorded by A. L. Griffith, who tabulates the arguments for and against gap regeneration and concentrated plantations from the silvicultural, management, financial and psychological standpoints. According to the modern view, gap regeneration, though financially sound in itself, does not compare silviculturally, economically or in management with small plantations of equivalent area in the best parts of the selection-worked coupes.

In Assam, compensatory plantations are the general rule, area being regulated by the yield of timber extracted. K. Krishnaswami's paper describes the successful gap regeneration work done in Mysore. After enumerating from a theoretical and practical standpoint the factors adversely affecting regeneration in gaps he defines the conditions in which it is likely to succeed, viz., no patch should be less than 30 yards in diameter, marginal Bamboos should be destroyed, and site and species should be carefully selected. Information on the costs of the Mysore patch method is given by C. A. Jabbar.

The Conference resolved that adequate plantations within the coupe or elsewhere in irregular forests would replace deficiency in natural regeneration, and would be silviculturally and economically preferable to gap regeneration. The total area of plantation aimed at should be based on the area felled or the timber volume removed from the working circle.

24. TENDING OF STANDS AND TREES

24.2. Thinnings

24.21 : 07.2. SANT RAM, B. [Thinning research.] Paper (I). *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 10, 1941 (256-68).*

24.21 : 07.2. SAGREIYA, K. P. [Thinning research.] Paper (II). *Proc. 5th silvic. Conf. Dehra Dun, 1939*, Item No. 10, 1941 (269-72).

24.21 : 07.2. MOHAN, N. P. [Thinning research.] Paper (III). *Proc. 5th silvic. Conf. Dehra Dun, 1939* Item No. 10, 1941 (272-3).

24.21 : 07.2. RAYNOR, E. W. [Thinning research.] Paper (IV). *Proc. 5th silvic. Conf. Dehra Dun, 1939*, Item No. 10, 1941 (273-4).

24.21 : 07.2. KERMODE, C. W. D. [Thinning research.] Paper (V). With report of debate on Item 10. *Proc. 5th silvic. Conf. Dehra Dun, 1939*, Item No. 10, 1941 (274-7, 277-80).

B. Sant Ram's paper is a comprehensive exposition of the aims and methods of thinning research; it deals with the development of tree classification, types of thinnings, comparative thinning experiments in India and Burma, variations in thinning grade and thinning cycle, control of treatments, and assessment of results of comparative experiments and of results on an economic basis. K. P. Sagreiya describes the nature of the problem and experimental work in the Central Provinces. N. P. Mohan states that the main problem in the Punjab is to determine the technique and suitable criteria for thinning young crops of conifers; investigations have been started on suitable spacings in early thinnings. E. W. Raynor enumerates some of the special and general thinning problems in the United Provinces. The paper by C. W. D. Kermode records what was done in Burma in the few years before 1939, chiefly for *Tectona grandis* and *Xylia dolabriformis*, and makes suggestions for an all-India-Burma co-operative investigation of different types of thinnings. The special committee's report on improvements in the technique of thinning research makes 12 recommendations including a modified tree classification, the use of statistical methods and comparison on a monetary basis.

24.25 : 12.26-8. WIEDEMANN, E. Lichtungsbetrieb und ungleichaltrige Bestandsformen im reinen Buchenbestand. [The open-stand system of management and uneven-aged types of stand in pure Beech forest.] *Z. gesamte Forstw.* 75 [69], 1943 (227-74). [G.]

The effects of very heavy thinning of middle-aged (60- to 90-year-old) Beech stands, made with a view to removing a large volume of timber and, at the same time, concentrating production on selected stems, are examined on the basis of sample-plot investigations in different parts of Germany.

Stands so treated have about half the number of stems and two-thirds the basal area and volume compared with moderately thinned stands, and very heavy thinning is generally followed by a reduction in current volume increment of 10-20 per cent., the reduction being greater in plots with dense regeneration than in those with little or none. Sudden opening of the stand by very heavy thinning tends to reduce current volume increment more than does a gradual thinning of equal intensity, since the former results in a considerable decrease in height growth. In the present paper a yield table is given for guidance in making a gradual very heavy thinning. On the whole, the quality of produce is not improved by a system of management involving such thinnings, though the diameter increment of the remaining stems is greatly increased, as is the ratio of increment to growing stock. Very heavy thinning does not appear to have any permanent detrimental effect on the soil.

24.3. Opening of the Canopy. Release and Improvement Fellings

24.3 : 60.31.2 : 52.46 : 32.1. LOCKYARD, C. R. A rapid forestry control system. U.S. Forest Service. 1942. pp. 14 + 4 appendices. [Northeastern Forest Exp. Sta.]

A system of light and frequent improvement cuttings has been applied successfully to farm woods by the Northeastern Forest Experiment Station in its work with the Otsego Forest Products Cooperative Association Inc. in the Cooperstown unit, New York.

The technique is based on a 100 per cent. survey, simplified so that only three size classes are distinguished, viz., poles, small saw timber, and large saw timber. The poles are grouped into one class; the percentage of their volume that is suitable for industrial use can be estimated with sufficient accuracy for practical purposes. Both small and large saw timber is classified as either industrial wood or fuelwood, and, in addition, the larger material is classified by 2-in. diameter classes. For poles and small saw timber the species composition is estimated, while for large saw timber the industrial wood is tallied by species. Local standard volume factors are used in computing and all volumes are expressed in cu. ft.

With the information thus obtained, together with a knowledge of the regional growth rate by size groups and species, it is possible to determine the volume to be removed during the cutting cycle. All necessary computations are made in the field, and the marking follows immediately on the survey.

24.3 (47.1) : 23.13. HEIKINHEIMO, O. Finsk offensiv mot skräpskogen. Lag om skyldighet att iständsätta skogar i under produktion. [Finnish offensive against low-grade forest. Law concerning the obligation to put in order forests in underproduction.] *Skogen* 31, 1944 (39-42). [Sw.]

A law passed in Finland in 1943 gives forest conservation committees the right to decide where improvement fellings for fuelwood production shall be made in private forests, and the methods to be used. Regeneration measures are supervised by the committees, the costs being met with funds provided for forestry amelioration and by some exemption from taxes.

It is estimated on the basis of the most recent State Forest Survey that a total area of nearly 2 million ha. of forest will come under the new law.

24.36 : 56.02 : 12.26-8. ZILLGITT, W. M. Growth response in Sugar Maple following light selective cutting. *J. For.* 42, 1944 (680). [Lake States Forest Exp. Sta.]

Measurements show that the diameter increment of Sugar Maple (*Acer saccharum*) trees (10 to 23 in. d.b.h.) increased by about 15 per cent. during the 17-year period following a light selective cutting, as compared with the growth during the 17-year period preceding the cutting. For the whole period, both before and after cutting, the ratio of diameter growth at any given level to the growth at b.h. was found to equal the ratio of the diameter at that point to d.b.h.

24.4. Shelterbelts. Windbreaks

24.4 : 23.21 : 23.24 : 12.25-8. COUTTS, J. Hedges and screens. *J. R. hort. Soc.* 69, 1944 (155-63, 192-202). O.B.D.

For planting on a large scale, a hedge plant should be hardy, cheap, and easily propagated. Some species,

SILVICULTURE

such as the native Hawthorn, Holly, Yew, Beech and Hornbeam, are commonly used and well suited for this purpose, but there are many other trees and shrubs (including some exotics) which are also capable of making good hedges.

Advice is given on the planting and management of hedge plants. Suitable species are listed alphabetically and briefly discussed under three headings: (1) utility hedge plants; (2) evergreens; and (3) deciduous plants.

A short section is added on plants useful for forming screens when trained to grow on trellis-work or some similar support.

24.4 : 23.21 : 97.2. The shelterbelt. *Chron. bot.* 7, 1943 (430-1). O.B.D.

The programme begun in 1934 for the establishment of shelterbelts in an effort to reclaim the agricultural region of the Great Plains of the United States from wind erosion, has met with outstanding success. The 190,000,000 trees planted by the Forest Service and the W.P.A. up to the end of 1941 already give protection to 4,000,000 acres of farm land, and there has been a marked increase of wildlife in the area, particularly of game and insectivorous birds.

The shelterbelts are not of fixed width or orientation, but are varied to suit local conditions. The species used also vary according to the locality. Some of the more common shrubs and trees planted in the shelterbelt areas are Buffaloberry, Golden Currant, American Plum, Chokeberry, Golden Willow, White Willow, Boxelder, American Elm, Bur Oak, Green Ash, Cottonwood, Black Locust, Black Walnut, Osageorange, Sycamore, Texas Walnut, Blue Spruce, Western White Spruce, Jack Pine, Shortleaf Pine, Rocky Mountain Juniper, and Eastern Red Cedar.

In most cases $8\frac{1}{2}$ acres of shelterbelt are sufficient to protect a 160-acre farm.

24.4 (931) : 23.21 : 12.25 : 12.26-8 : 23.24-6 : 45.11 : 97.2. SYME, P. S. Farm shelter. *N.Z. J. Agric.* 68, 1944 (89-97). O.R.E.

This paper deals in particular with shelter requirements and species used in New Zealand.

Two distinct types of shelter must be taken into consideration in designing a programme for farm windbreaks: (1) belts of high trees to protect the farm against the worst prevailing winds, and (2) a series of low, dense hedges to provide shelter for individual fields. A properly designed shelterbelt 66 ft. high will afford protection for about 350 ft. and partial protection for about 1,000 ft. The aspect of the shadow cast by a windbreak must not be overlooked in planning the position and direction of the shelter desired.

In coastal areas, which are exposed to severe and constant winds, it may be necessary to provide first an artificial windbreak of Tea tree scrub and to plant native plants such as *Veronica elliptica*, *Pittosporum crassifolium* and flax on the lee of this before trying to establish a tree belt. A sample windbreak for coastal areas is composed as follows:—One or two rows of *Pinus pinaster* spaced 6 ft. each way, fronting the seaward side; one or two rows of *P. pinaster* or *P. muricata* spaced 6 ft. each way; a few rows of *P. radiata* spaced 6 ft. each way, and one row of *Cupressus macrocarpa* 5 ft. apart and about 20 ft. from the Pines.

For inland areas an excellent shelterbelt may be designed as follows:—One or two rows of Corsican Pine, 6 ft. apart, on the windward side; one or two rows

of *Pinus muricata*, 6 ft. apart; one row of *Cupressus lawsoniana* or *C. benthamii* spaced 4 ft. apart and about 20 ft. from the Pines.

Other suitable species for use in windbreaks are also suggested (including Black Wattle, Lombardy Poplars and certain Eucalypts).

For low hedges to protect individual fields *Cupressus lawsoniana* is perhaps the most suitable species, but *C. benthamii*, *C. macrocarpa*, *Hakea saligna*, Seedless Barberry, *Acacia verticillata*, Boxthorn, *Eleagnus japonica*, Bamboo, New Zealand flax and pampas grass are among the other species from which a selection may be made.

Notes are given on the suitability of individual species for use as windbreaks, and short sections are included on the growing of trees from seed, striking cuttings, the planting of young trees, the trimming of hedges, and the protection of shelter plants from browsing by stock.

24.5. Pruning

24.51 : 07.7. SJÖSTRÖM, H. Grönkvistning av växande träd. Några nya redskap. [Live pruning of growing trees. Some new implements.] *Skogen* 31, 1944 (46-7). [Sw.]

Two new implements which are particularly well adapted for live pruning of trees such as Pine, Spruce, Birch and Oak are the Berghoof shears and a double-bladed pruning saw.

The shears can be used in pruning to a height of about 2.5 m. above the ground; branches up to an inch thick of such hardwoods as Oak can be cut without difficulty. Provided it is kept sharp, a particularly clean cut can be obtained with this tool.

The double-bladed pruning saw is an application of the principle that very thin and relatively fine-toothed saw blades produce smooth cut surfaces and make possible a high output of work. In pruning trees with hard branch wood, such as Spruce and Oak, blades as thin as possible should be used to get the best results. The blades are placed at a slight angle to the frame for ease of operation. Worn blades are easily replaced in the field.

The two implements described can also be employed in dry pruning. The best results are obtained by their joint use. R. P. J.

24.51 : 33.03. COX, H. A. Pruning. *Emp. For. J.* 23, 1944 (73 + plate).

Among the requirements in high-grade 'peeler' logs is that knots be restricted to the central core; hence pruning is an important operation in stands intended for the production of such logs. Best results are obtained by pruning the branches while they are still alive and of relatively small diameter, and by making the line of the cut coincide as nearly as possible with that of the cambium in the stem. Loosening or tearing the bark of the trees should be avoided.

24.51 (410). The pruning of forest trees. *Quart. J. For.* 38, 1944 (73-6).

A general discussion on pruning with reference to (1) the straightening of trees in very young plantations, (2) the pruning of live branches that are shaded, (3) the season for pruning, and (4) pruning tools.

24.51 : 12.25. COX, H. A. Brushing conifers. *Quart. J. For.* 38, 1944 (113-4). [Forest Products Research Laboratory, Princes Risborough, Bucks.]

SILVICULTURE

Cf. *For. Abstr.* 6 (92). Reasons are given to show that a pruning saw is a better tool than a billhook for brashing conifers.

24.51 : 12.25 : 56.01-02. DOWNS, A. A. Growth of pruned Eastern White Pine. *J. For.* 42, 1944 (598). [Appalachian Forest Exp. Sta., Asheville, N.C.]

Tentative conclusions as to the effect of pruning on the subsequent growth of Eastern White Pine (*Pinus strobus*) [cf. *For. Abstr.* 5 (180)] are confirmed by additional data. So far as subsequent diameter growth is concerned, it is shown that heavy pruning (the removal of 26-35 per cent. of live branch whorls) can safely be used with trees of this species being grown for the production of sawlogs.

24.51 : 12.26-8. ZIMMERLE, H. Über Ästungsversuche bei der Rotbuche. [On pruning experiments with

Beech.] *Allg. Forst- u. Jagdztg.* 119, 1943 (88-104). [G.] [Forstliches Versuchswesen Württembergs.]

Preliminary notes on investigations begun in 1930 at the Württemberg Forest Research Station on the following methods of pruning young Beech stands: (1) flush with the stem; (2) leaving a stub 15-20 cm. long; (3) same as (2), leaving one green branch on the stub. In all cases the branches pruned were of small (2-5 cm.) diameter. Method (1) gave rapid and satisfactory occlusion, but a brown 'protection tissue' was formed in the stem under the cut; this may impair the future quality of the timber. Methods (2) and (3) proved disappointing; the natural dying off of the stubs was extremely slow, and where these were removed in a second pruning operation there was a pronounced formation of wound tissue leading eventually to large bulges on the stem surface.

3. FOREST UTILIZATION. FOREST TECHNOLOGY

31. PROPERTIES AND ANATOMY OF WOOD. WOOD RESEARCH

31 : 01.4. RUNKEL, R. Die Erforschung der Holzkstitution und ihre Methoden. I. [Research on the constitution of wood and its methods. I.] *Cellulosechemie* 20, 1942 (111-9 + plates). [G.] [Reichsinstitut für ausländische und koloniale Forstwirtschaft, Reibek, Bz. Hamburg.] P.R.

A general discussion of modern methods of anatomical, chemical and physical research on wood.

31 (410). Institutos de investigaciones de las maderas. El Laboratorio de Investigaciones de Productos Forestales de Princes Risborough, Inglaterra. [Institutes for wood research. The Forest Products Research Laboratory, Princes Risborough, England.] *Maderil* 16 (189), 1944 (11-6, 27). [Span.]

A note on the organization and work of the Laboratory, based on a report by Professor J. Campedron, Director of the Testing Laboratory of the National Timber Institute of Paris.

31 (68) : 33.36.1 : 33.36.3 : 12.26-8. S. African timber enterprise. *Timb. Tr. J.* 170, 1944 (486).

Notes on the activities of the Forest Products Institute at Pretoria West. Among its main achievements have been the development of many new uses and preservative-treatment techniques for Eucalypt timbers, and the elaboration of methods for the seasoning and preservative treatment of indigenous hardwoods.

31 (94). Institutos de investigaciones de las maderas. La Division de Productos Forestales de Melbourne, Australia. [Institutes for wood research. The Division of Forest Products, Melbourne, Australia.] *Maderil* 16 (192), 1944 (7-9). [Span.]

A note on the organization and activities of the Australian Division of Forest Products.

31.0. General Information on Woods

31.0 : 12.26-8. The properties of Australian timbers: Crow's Ash (*Flindersia australis*). *Mon. News Lett. Div. For. Prod. Aust.* No. 129, 1944 (5).

31.0 : 12.26-8. The properties of Australian timbers. Rose Mahogany (*Dysoxylum fraserianum* Benth.) *Mon. News Lett. Div. For. Prod. Aust.* No. 130, 1944 (5-6).

31.0 (73) : 12.25 : 12.26-8. BETTS, H. S. American woods. U.S. Forest Service, Washington, D.C. 1942-44.

Twenty-six pamphlets which are part of a series, each giving briefly the description, nomenclature, distribution and growth, supply, production, properties, and principal uses of one of the commercial forest trees of the United States. These pamphlets, some of which are revisions, deal with: Eastern Hemlock (*Tsuga canadensis*), Redwood (*Sequoia sempervirens*), White and Grand Fir (*Abies concolor* and *A. grandis*), Noble Fir (*A. nobilis*), Eastern Spruce (*Picea* spp.), Bald Cypress (*Taxodium distichum*), Eastern White Pine (*Pinus strobus*), Tamarack (*Larix laricina*), Basswood (*Tilia glabra*), Elm (*Ulmus* spp.), Black Cherry (*Prunus serotina*), Buckeye (*Aesculus* spp.), Hickory (*Carya* spp.), Sycamore (*Platanus occidentalis*), Persimmon (*Diospyros virginiana*), Black Walnut (*Juglans nigra*), Butternut (*J. cinerea*), Yellow Poplar (*Liriodendron tulipifera*), Maple (*Acer* spp.), Birch (*Betula* spp.), Chestnut (*Castanea dentata*), Ash (*Fraxinus* spp.), Black Locust (*Robinia pseudoacacia*), Beech (*Fagus grandifolia*), Aspen (*Populus tremuloides* and *P. grandidentata*), Cottonwood (*P. spp.*), Balsam Poplar (*P. balsamifera*). [Cf. *For. Abstr.* 4 (105, 230); 5 (180)].

31.0 (73) : 12.25 : 12.26-8 : 12.19 : 21. Useful trees of the United States. U.S. Forest Service, Washington, D.C. 1943.

Seven leaflets of a series, each giving brief notes on the distribution, tree characters, wood properties and uses, etc. for one of the economically useful trees of the United States. These leaflets deal respectively with Eastern Red Cedar (*Juniperus virginiana*), Redwood (*Sequoia sempervirens*), White Ash (*Fraxinus americana*), American Elm (*Ulmus americana*), Black Walnut (*Juglans nigra*), Yellow Birch (*Betula lutea*), American Beech (*Fagus grandifolia*).

31.1. Structure. Anatomy. Identification

31.1. The identification of timbers. *Leaflet. For. Prod. Res. Lab.* No. 34, 1944, pp. 10.

The principal structural features of wood are described and illustrated and it is shown how these may be used to identify timbers. Diagnostic features of the principal commercial softwoods and the more common hardwoods are summarized in tabular form.

31.1. RECORD, S. J. Keys to American woods (continued). *Trop. Woods* No. 79, 1944 (25-34).

This is the fourteenth key of the series. It deals with dicotyledonous woods in which the xylem rays are virtually all uniseriate, only occasional cells being paired. Included in the key are some woods having latex tubes in a few of the rays.

31.1 : 12.26-8. CHALK, L. On the taxonomic value of anatomical structure of the vegetative organs of the Dicotyledons. 2. The taxonomic value of wood anatomy. *Repr. from Proc. Linn. Soc. Lond., 1942-43 155th Session, Part 3, 1944 (214-8).* [Imperial Forestry Institute, Oxford.]

Systematic wood anatomy is based on a very limited number of features and species compared with taxonomic botany and is thus better fitted to supplement the general or natural classifications of botanists, by increasing the number of characters for correlation, than to provide an independent natural classification. The wood anatomist, therefore, tends to try to fit his results into those of systematic botany and to be especially interested in distinguishing between variation that is the result of sampling or conditions of growth, and differences that may be of taxonomic significance.

Examples are given to illustrate the potential value of wood anatomy in classifying the difficult genus and in deciding whether some genera should become monotypic families. One of the most striking features of wood anatomy is the uneven value of the larger systematic groups. Some sub-families are more distinct than are many families, others show no consistent differences in their wood anatomy. In the group of orders Tiliales, Sterculiales and Malvales it is easier to recognize a wood as belonging to the group as a whole than to assign it to any one family, though a few sub-families are distinct.

The most important rôle of wood anatomy at present is perhaps the negative one of drawing attention to cases where existing classifications are unsatisfactory. Its positive contribution is likely to grow in importance as the result of further research; already studies of the evolution of cells and tissues, particularly those relating to the significance of vessel development and of the length of the tracheary elements as measures of specialization, provide a useful check on series, genealogical trees and hypotheses as to the derivation of one group from another.

31.1 : 12.26-8. RENDLE, B. J. On the taxonomic value of the anatomical structure of the vegetative organs of the Dicotyledons. 3. The rôle of anatomy in the practical identification of commercial timber. *Proc. Linn. Soc. Lond., 1942-43 155th Session, Part 3, 1944 (218-21).* [Forest Products Research Laboratory, Princes Risborough, Bucks.] O.B.D.

In identifying timbers it is essential to discriminate between characters which are relatively constant and those which are liable to vary under different conditions of growth. Considerable experience is required to recognize the diagnostic features of a timber and to assess their value as family, generic or specific characters. Using features of proved diagnostic value it has been possible to develop a universal key for the identification of commercial timbers. Identifications based on a key should be confirmed by reference to a good description or an authentic specimen. The fine morphological differences which often separate closely allied species are not always reflected in the structure

of their wood. But for practical purposes it is not always necessary to determine the exact species because when two or more related species have practically the same wood structure they are generally treated as a single commercial timber. B. J. R.

31.1 : 12.26-8 (81). MILANEZ, F. R. Anatomia das principais madeiras brasileiras das Rutaceae. [Anatomy of the principal Brazilian woods of the Rutaceae.] *Rodriguesia* 7 (16), 1943 (5-22 + plates). [Port.]

The paper includes a key for the identification of these woods, based on anatomical characters, and microphotographs showing the wood structure of a number of species.

31.2. Physical Properties

31.2 : 12.26-8 (54) : 12.19. CHOWDHURY, K. A. *Acacia catechu* var. *sundra*. *Indian For.* 70, 1944 (304-6). [Forest Research Institute, Dehra Dun.]

Wood of the Indian species, *Acacia catechu* var. *sundra*, has proved to be a good substitute for South American *Lignum-vitae* (*Guaicum officinale*) in the manufacture of propeller tail-shaft bearings. It was supplied to the Director-General of Shipbuilding and Repairs, Bombay, under the name of 'Red Ebony', but as it has no family connexion with the Ebonies, the names 'Lal Khair' and 'Red Cutch' are preferred by the writer for commercial use. The tree is known to grow in Coimbatore and in the Deccan, north of the River Krishna, and is common also in Kanara, Konkon, Kathiawar, Rajkot, Gujrat and Rajputana.

31.23. Weight. Specific Gravity

31.23 : 12.25-8 (410 : 97). PETTIFOR, C. B. Average weights of timbers. Mean weights and ranges of weights for some home-grown and Empire timbers. *Wood* 9, 1944 (232-3). [Forest Products Research Laboratory, Princes Risborough, Bucks.]

Including diagrams showing the range of weights of a number of British-grown, Empire, and aircraft timbers at 50 and 15 per cent. moisture content.

31.27. Mechanical Strength

31.27 : 33.8. KRZWOLOCKI, Z. Stress problems in the design of wooden airplanes. *J. aero. Sci.* 11 (1), 1944 (76-82).

Various fundamental design formulae are given. Strength/weight ratios and brittleness are referred to, and probable future design tendencies are suggested.

The opinion is expressed that the high damping capacity of wood and plywood is responsible for reducing the amplitude of structural vibrations well below and approaching the critical frequency (resonance), but that near to and at the critical frequency the effective damping is suddenly reduced and the well-known 'explosive' type of failure results.

31.27 : 38.2. MORELLI, D. A. A critical review of the C.S.I.R. timber column formula. With discussion by I. Langlands. *J. Instn. Engrs. Aust.* 15, 1943 (135-9). L.S.

31.27 : 12.25-8. SCHAPHORST, W. F. Easy way to figure your wooden beams. *Sth. Lumberm.* 169 (2120), 1944 (50).

The rule accepted by the American Railway Engineering Association for determining the maximum safe load of wooden beams is to multiply the area of the section

of the beam in sq. in. by the safe unit stress for longitudinal shear, and multiply that product by 1.33. Similarly the rule for determining the limiting length of a span in feet is to multiply the allowable compressive fibre stress of the beam in lb. per sq. in. by the width of the beam in inches, multiply the result by the square of the depth of the beam in inches, and then divide by 9 times the total uniformly distributed load in lb.

Safe unit stresses for longitudinal shear and safe compressive fibre stresses parallel to the grain, as recommended by the Association, are given for some common North American woods.

31.27 : 12.26-8 : 38.1. KINGSTON, R. S. T. Tests on bridge decking. *Repr.* No. 59 from *J. Coun. sci. industr. Res. Aust.* 12, 1939 (158-60).

Recently tests were carried out at the Division of Forest Products, C.S.I.R., Melbourne, to obtain information on the behaviour of unusually thin wooden bridge decking; the material used was believed to be *Eucalyptus gonicalyx* or possibly *E. globulus*. The results indicate that 2-in. decking is quite satisfactory from the point of view of both strength and stiffness.

31.3. Chemical Properties

31.3. SCHÜTZ, F., and SARTEN, P. Beiträge zur Holzchemie. Über die Bildung von Lignin aus Holz und Holzextrakten und die Oxydation der Zucker, der Cellulose, des Holzes und der Holzextrakte mit Diazoverbindungen zu Säuren der Zuckergruppe. [Contributions to the chemistry of wood. On the formation of lignin from wood and wood extracts and the oxidation of sugar, cellulose, wood, and wood extracts with diazo compounds to acids of the sugar group.] *Cellulosechemie* 21, 1943 (35-48). [G.] P.R.

31.3. FISHER, H. E., KULKA, M., and HIBBERT, H. Studies on lignin and related compounds. LXXXIX. Synthesis and properties of 3-hydroxy-1-(3, 4-dimethoxyphenyl)-2-propanone. *J. Amer. chem. Soc.* 66, 1944 (598-601). [McGill Univ.] O.R.S.

31.3. MITCHELL, L., and HIBBERT, H. Studies on lignin and related compounds. LXXX. The ethanolysis of 1-acetoxy-1-(4-acetoxy-3-methoxyphenyl)-2-propanone and its relation to lignin structure. *J. Amer. chem. Soc.* 66, 1944 (602-4). [McGill Univ.] O.R.S.

31.3. MITCHELL, L., EVANS, T. H., and HIBBERT, H. Studies on lignin and related compounds. LXXXI. Properties on 1-bromo-1-(4-acetoxy-3-methoxyphenyl)-2-propanone and relation to lignin structure. *J. Amer. chem. Soc.* 66, 1944 (604-7). [McGill Univ.] O.R.S.

31.3. GARDNER, J. A. F., and HIBBERT, H. Studies on lignin and related compounds. LXXXII. Synthesis and properties of 1, 3-diacetoxy-1-(4-acetoxy-3-methoxyphenyl)-2-propanone and 1-acetoxy-3-chloro-1-(4-acetoxy-3-methoxyphenyl)-2-propanone and their relation to lignin structure. *J. Amer. chem. Soc.* 66, 1944 (607-10). [McGill Univ.] O.R.S.

31.3 : 33.32. PENN, W. S. Lignins and their plastics: a vast source of potential raw materials. *Brit. Plastics* 16, 1944 (194-8). L.S.

31.3 : 12.25. BUCHANAN, M. A., and BRAUNS, F. E. Acetic acid Spruce lignin. *Abstr. in Pulp Paper Mag. Can.* 45, 1944 (752). [Institute of Paper Chemistry, Appleton, Wis.]

31.3 : 12.25 : 33.32. ERDTMAN, H. Die Konstitution der Harzphenole und ihre biogenetischen Zusammenhänge VIII. Zur Kenntnis des Conidendrins (Sulfit-laugenlactons) und dessen Verbreitung unter verschiedenen Coniferen. [The constitution of the resin phenols and their biogenetic relationships VIII. On conidendrin ('lactone from waste sulphite liquors') and its occurrence among different conifers.] *Svensk Papp-47*, 1944 (155-9). [G.] P.O.

Conidendrin is extractable from Spruce wood with acetone. By sulphite digestion of wood from different conifers and examination of the waste liquors, it has been found that 7 out of 14 species of Spruce and the 14 *Tsuga* species examined contained conidendrin, while out of the 7 *Abies* species examined only one contained this constituent and that result is not certain. None of the *Pinus*, *Pseudotsuga* and *Larix* species examined was found to contain conidendrin, which was, however, found with matairesinol in the resinous exudates of *Podocarpus spicatus*. Pinoresinol has been detected in the resinous exudates of some species of Pine and Spruce containing conidendrin. M. L. C. W.

31.3 : 12.25 : 34.26. ANDERSON, A. B. Chemistry of Western Pines. Proximate analysis of Ponderosa, Idaho, White, and Sugar Pines. *Industr. Engng. Chem. (Industr. Ed.)* 36, 1944 (662-3). [Western Pine Association Research Laboratory, Portland, Oregon.] P.R.

As a basis for the effective utilization of chemical products from commercially important Pines growing in western North America (*Pinus ponderosa*, *P. monticola* and *P. lambertiana*), the proximate chemical composition of the woods of these species was determined, using carefully identified samples of each wood taken in a 4-ft. bolt from the tree at a point approximately 20 ft. above the ground. Results are tabulated and summarized with reference to ash, extractives, pentosans and lignin, cellulose, and holocellulose. The woods of these species contain relatively large quantities of extractives, and preliminary investigation has shown that all or a portion of these can be removed from the wood; it is suggested that removal may improve the lumber as well as increase the commercial volume of extractive products. Both possibilities are being investigated.

31.3 : 12.25 : 12.26-8. BERTRAND, G., and BROOKS, G. Acetic acid compounds in wood and lignified tissue. *Compt. rend. No. 212*, 1941 (739-43). *Chem. Abstr.* 38 (2188). P.R.

The lignified tissues of a variety of woods contain considerable proportions of HOAc, probably combined as esters and easily liberated on hydrolysis with H_2SO_4 . Wood of the angiosperms is richer in HOAc than that of the gymnosperms. In conifers the HOAc content of the wood of the branches and trunk is about the same, but in the angiosperms the HOAc content is greater in the branches, 6.56 against 5.76 per cent. of the dry weight. It is possible that the pectins supply some of the HOAc derived from wood.

31.3 : 33.15 : 33.32. NICHOLLS, R. V. V. Plastics from wood and for wood improvement. *Pulp Paper Mag. Can.* 45, 1944 (308-12). [McGill Univ., Montreal.]

A brief review article dealing with wood and wood constituents and their role in industrial development. A list of 33 literature references is given.

31.4. *Durability. Decomposition*

31.42. Attack by Plant Organisms

31.42.1 : 12.21. ULBRICH, E. Hausschwamm, Nassfäulen (Trockenfäulen) und andere Zerstörer unserer Häuser und Bauten. Ratgeber zur Verhütung von Pilzschäden. [Dry rot, wet rots (dry rots), and other destroyers of our houses and buildings. A guide to the prevention of fungal damage.] P. Parey, Berlin. 1941. pp. 88. R.A.M. 23 (322).

This publication, the first to be issued by the Mycological Department of the Botanical Museum, University of Berlin, is stated to cover in a concise and popular form, without neglecting the mycological aspects of the subject, a variety of problems connected with timber preservation against dry rot (*Merulius laeprymans*) and other *M. spp.*, *Coniophora* and *Coniophorella spp.*, *Poria spp.*, and other wood-destroying fungi. Other sections deal with the 'bluing' of wood by Ascomycetes (including *Ceratostomella spp.*), moulds on food, household utensils, and the like, and the control of the various forms of damage.

31.42.1 (73) : 44.3 : 33.36.1. Report on forest pathology, Southern Region, for American Phytopathological Society War Emergency Committee. U.S.D.A. Bureau of Plant Industry [Washington, D.C.] [1942.] pp. 8.

Among the subjects briefly dealt with in this report are: (1) measures for protecting buildings against decay; (2) the protection of logs and lumber against sap stains; (3) the durability of untreated fence posts and crossies; (4) decay and staining of Pine pulpwood; (5) the effect of deterioration of Chestnut on tannin extraction; (6) measures for improving the health of forest stands; and (7) the availability of spraying and dusting equipment and of fungicides.

31.42.11 : 12.25 : 12.21 : 31.3. ERDTMAN, H., and RENNERTFELT, E. Der Gehalt des Kiefernholzes an Pinosylvin-Phenolen. Ihre quantitative Bestimmung und ihre hemmende Wirkung gegen Angriff verschiedener Fäulpilze. [The pinosylvinphenolic content of Pine heartwood, its determination and its antiseptic action towards wood-destroying fungi. *Svensk PappTidn.* 47, 1944 (45-56). [G.s.w.e.] P.O.]

The heartwood of Pine (*Pinus sylvestris* L.) is more resistant to wood-destroying fungi than the sapwood, owing largely to the presence of poisonous phenols, pinosylvine and pinosylvine monomethyl ether. A method for estimating the total amount of these phenols in Pine heartwood has been worked out as follows:—Extracts of the heartwood are purified until mainly phenolic constituents remain. The pinosylvine phenols when oxidized with potassium permanganate yield benzoic acid which is easily estimated. The red coloration of Pine heartwood caused by bisdiazotised benzidine is related to the content of pinosylvine phenols, and colorimetric methods may be used accordingly.

The amount of pinosylvine phenols varies in different parts of a tree: it is higher in the butt (over 1 per cent.) and the branches (up to 3 per cent.) than in the trunk. Generally, the periphery of the heartwood contains more of these phenols than the centre. Analytical results and qualitative coloration experiments indicate two different types of Pines: those characterized by a great difference in phenol content between the periphery and the centre of the heartwood, and those in which these substances are more evenly distributed.

Experiments have been made to determine the ability of different wood-destroying fungi to attack sapwood, and peripheral and central heartwood, the wood used showing a pronounced difference in pinosylvine phenol content of peripheral and central heartwood. Results varied with species of fungi used: sapwood and heartwood were attacked with much the same ease by *Lentinus squamosus*, there was a distinct difference in attack on sapwood and heartwood by *Coniophora cerebella*, and peripheral heartwood suffered very slight attack by *Polyporus vaporarius*. In experiments on agar medium, however, the growth of all three fungi was inhibited by the same concentration of phenol, and there appears to be no relation between the inhibiting action of these substances in agar cultures and in natural heartwood. No explanation of this fact is given but it is pointed out that wood density and resin content appear definitely to be of minor importance in regard to the ability of these fungi to attack Pine wood.

31.42.11 : 33.8 : 33.36.1. HARTLEY, C., and MAY, C. Decay of wood in boats. U.S.D.A. Bureau of Plant Industry [Washington, D.C.] 1943. pp. 12 + plate.

After a brief outline of the nature and causes of decay, the authors discuss the decay hazard and those parts of a boat most subject to decay. Factors important in hastening decay have been (1) the use of sapwood, (2) the use of heartwood of species with low decay resistance, (3) the use of unseasoned wood, (4) leaky seams, and (5) lack of proper ventilation. The decay hazard may be reduced by (1) the use of decay-resistant wood, (2) the use of seasoned wood, (3) avoidance of sources of infection, (4) preventing the entry of water (particularly fresh water) through leaky seams and joints, (5) adequate ventilation, and (6) the use of wood preservatives.

31.42.12 : 33.36.3 : 32.82. RENNERTFELT, E. Blånad och blåytesvampar. [Blue stain and blue discoloration fungi.] *Skogsägaren* 20, 1944 (84-8, 91). [Sw.]

Factors affecting the spread of these fungi and methods for their control are discussed. A moisture content in timber of 35-135 per cent. is favourable for their growth. From studies still in progress it appears that if winter-felled, unbarked timber is properly protected from insects that spread these fungi, it is as a rule less subject to blue stain than summer-felled timber.

Blue stain of sawn timber can be effectively controlled by chemical treatment or by kiln drying. Control in the log is more difficult and costly. Methods that have been under test since 1938 are designed to retain the moisture content of logs at a level high enough to prevent fungus development.

Transmission of the fungi by insects appears to result in more extensive staining than if the infection is wind-borne. Arsenical preparations have proved effective against the insects, and mercury compounds in control of the blue stain. Care should be taken in applying arsenical solutions, as it has been found that timber sprayed with these materials may be more severely stained than untreated timber; they should be applied only to those parts where the bark is intact. After spraying, the logs are piled and covered to prevent drying out.

31.42.12 : 12.26-8 : 33.36.1 : 33.36.3. HARTLEY, C., and SCHEFFER, T. C. Recommended practice for controlling sap stain in aircraft Yellowpoplar lumber. Forest Products Laboratory, Madison, Wis., *Mimeo* No. 1378, 1943. pp. 4.

Recommendations are made with reference to early conversion or chemical treatment of logs, and the kiln drying, chemical dipping or air seasoning of lumber. The proprietary chemicals used in stain prevention are Dovicide H, Lignasan, and Permatox 10 S. Equipment and methods used in the dipping of lumber are described and precautions in the use of stain-preventive chemicals are noted.

31.43. Attack by Animal Organisms

31.43 : 13.2. SCHMITT, J. B. Powder post beetles. *Circ. N.J. agric. Exp. Sta. No. 442*, 1942. pp. [2].

Advice on the prevention of infestation or re-infestation of wood by *Lyctus* spp. and on the control of established infestations.

31.43 : 13.2 : 33.36.1. Damage to sapwood of hardwoods by powder-post beetles. *Bull. S. Rhod. Minist. Agric. No. 1259*, 1944. pp. 7. *Repr. from Rhod. agric. J.* 41 (2), 1944 (73-8).

After a brief account of the appearance and life history of Lyctid and Bostrychid beetles, measures are discussed for the prevention and control of beetle attack. These include kiln sterilization and treatment with preservatives such as creosote or aqueous solutions of various chemicals. It is suggested that timber be kept in the log as long as possible, since in this form the moisture content will be maintained at a level too high for powder-post beetle attack for a relatively long period. Research is being carried out on the practicability of removing starch from green timber by delayed conversion of logs, by immersing logs in water, and by girdling standing trees some months before felling.

A note is included on damage by pinhole borers or ambrosia beetles; attack by these beetles ceases when the timber is properly seasoned.

31.43 : 13.2 : 31.3. HENDERSON, F. Y. The depletion of starch from the sapwood of the Ash (*Fraxinus excelsior*) and its relation to attack by powder-post beetles (*Lyctus* spp.). With appendix by E. W. Bennison. *Ann. appl. Biol.* 30, 1943 (201-8). [Imperial College of Science and Technology, London.] O.R.S.

The depletion of starch in the living sapwood of Ash was examined as a possible means of rendering converted timber immune from attack by *Lyctus*.

Observations on disks of timber kept under controlled conditions showed that depletion is conditioned by access of oxygen; thus although in the standing tree depletion proceeds from without inwards, it can be induced in any part of the sapwood, and in any direction, by permitting access of oxygen. The optimum temperature range for depletion in Ash is from 31° to 36° C.; above 45° C. death of the cells may interrupt depletion.

Infestation experiments upon timber undergoing depletion showed that the attack by *Lyctus* is circumscribed by starch-level and not by total nitrogen or soluble sugars. Under correct conditions of kilning, 1 in. sapwood plank can be rendered starch-free in about 20 days; with larger sizes depletion is uncertain and probably uneconomic. *From author's summary.*

31.43 (73) : 13.2. SNYDER, T. E. Powder-post beetles and their control. *Pests* 12 (4), 1944 (8, 27-31). *Biol. Abstr.* 18 (14852).

A popular account of the powder-post beetles of economic importance in the United States. In the southern States at least 38 species, representing

6 families, caused damage to buildings, furniture, implement handles and other seasoned wood products. Preventive and remedial measures are described.

31.43 (931) : 13.2 : 33.36.1. SMITH, J. H., and FORBES, A. C. How to defeat wood borers. *N.Z. J. Agric.* 68 (2), 1944 (83, 85-8). [State Forest Service, Wellington.] O.R.E.

The principal wood-boring insects which cause damage to buildings and interior woodwork in New Zealand are (1) the common house borer (*Anobium domesticum* Linn.), (2) the powder post beetles (*Lyctus* spp.), (3) the native two-toothed long-horn (*Ambeodonotus tristis* Fabr.), and (4) the native termite (*Calotermes brouni* Frogg), and some species introduced from Australia. The distinguishing features of wood attacked by the above insects are briefly outlined, and the main stages in the life cycle of each species are indicated.

Stress is laid on the necessity for frequent thorough inspections of all woodwork, especially in new buildings, and on the immediate removal or treatment of borer-infested wood. For either exterior or interior use, where its smell is not objectionable, creosote is the most effective protection against boring insects. For the treatment of house interiors and furniture a toxic chemical dissolved in a cheap organic solvent is recommended. The following solution is suitable for such purposes:—

pentachlorophenol	5 parts by weight
light diesel oil or kerosene	94 " " "
Pine oil	1 part " "

For timber *in situ* the brush or spray method must be used, the preservative being flooded over the surface of the wood and allowed to soak in. Particular care should be taken to force the preservative into the flight holes.

31.43 : 13.2 : 31.41 : 12.25-8 : 33.36.1. Termite-proofing of timber for use in the tropics. *Leaflet For. Prod. Res. Lab. No. 38*, 1944. pp. 6.

A summary of information on methods of preventing damage by termites. After a brief account of the types and general habits of termites, the author discusses the proper construction of buildings in termite-infested areas, the use of soil poisons, the preservative treatment of timber, plywood, and fibre or composition boards, and the use of termite-resistant woods. While there are no known woods of commercial importance which can be regarded as immune from infestation by termites, the heartwood of some species (e.g. *Chlorophora excelsa*, *Sarcocephalus diderichii*, *Sequoia sempervirens* and *Tectona grandis*) has been found to be highly resistant. It is generally better, however, to impregnate easily-treated, perishable timbers with standard chemical preservatives than to rely on naturally resistant woods.

The most suitable types of preservative for wood and wood products, whether in contact with the ground or in aerial structures, are indicated.

31.43 : 13.2 (74.9). SCHMITT, J. B. The prevention and control of termite damage. *Circ. N.J. agric. Exp. Sta. No. 484*, 1944. pp. 11.

The type of damage caused by the eastern subterranean termite (*Reticulitermes flavipes* Kollar), which is the species commonly found in New Jersey, is described and compared with that done by other wood-boring insects, e.g. powder-post beetles, longhorn beetles, and

FOREST UTILIZATION. FOREST TECHNOLOGY

certain species of ants. The main differences between the external features of flying ants and flying termites are listed and illustrated.

The author points out some factors in building construction which favour termite attack, and outlines the basic principles in the control of an infestation. He discusses various types of termite shields, indicates their limitations and use, and gives instructions for the proper application of soil poisons.

1.43 (68.9) : 12.25-8 : 33.36.1. DUFF, C. E. Termite resistance test on the Copperbelt of Northern Rhodesia. The Forest Department, Northern Rhodesia.] 1944. pp. 4 + 7.

Results of an experiment carried out at Ndola, Northern Rhodesia, on the termite resistance of twenty-six indigenous and three imported (coniferous) timbers both untreated and treated by immersion (open tank method) in one of the following preservatives: 1 per cent. arsenious oxide, 4.5 per cent. zinc chloride, 3 per cent. sodium arsenite, and 5 (?) per cent. copper sulphate. No marked difference in durability was observed between specimens treated with the two most satisfactory preservatives, arsenious oxide and sodium arsenite. The arsenic salts took 6 years to leach out under conditions of 50-inch rainfall. Impregnation with zinc chloride was effective for only two years, while specimens treated with copper sulphate showed only slightly greater durability than untreated wood.

The most durable and resistant species of untreated timber were *Baikiaea plurijuga*, *Afro[r]mosia angolensis*, *Amblygonocarpus obtusangulus*, *Entandrophragma caudatum*, *Pterocarpus angolensis*, *Albizia antunesiana* and *Erythrophloeum africanum*. The heartwood samples of these species remained almost unaffected after exposure to intense termite attack for 11 years.

1.43 : 12.26-8 : 13.2. EDMONDSON, C. H. Note on resistance of species of *Antidesma* to marine borers. *Trop. Woods* No. 79, 1944 (15). [Bernice P. Bishop Museum, Honolulu.]

Wood of Hawaiian-grown *Antidesma pulvinatum* Hillebrand showed no signs of infestation by shipworms after being submerged in sea-water for twelve months, and that of *A. platyphyllum* Mann showed no infestation after submergence for five months. In both species the surface was punctured by larvae of *Teredo*, but during the periods of observation no borers were able to establish themselves in the wood.

31.8. Quality and Defects of Timber

1.8 : 12.26-8 : 33.15 : 31.42-5 : 31.27. HANSBROUGH, R., WATERMAN, A. M., and LUXFORD, R. F. The significance of the discolorations in aircraft veneers: Yellow Birch. Forest Products Laboratory, Madison, Wis., Mimeo No. 1377, 1943. pp. 1 + 7 + plates.

Descriptions and illustrations are given of the common discolorations and decays of the wood of Yellow Birch (*Betula lutea*) together with the results of tests made to compare the toughness of discoloured wood with that of clear wood from the same sheet of veneer. Common forms of discoloration are mineral streaks and heartwood streaks in the sapwood, and striped and banded zones, mineral streaks, and light streaks in the heartwood. Discoloration due to decay is the only form associated with excessive reduction in toughness.

31.8 : 12.26-8 : 31.1 : 31.21 : 31.23 : 32.24. Selecting Ash by inspection. *Leaflet For. Prod. Res. Lab.* No. 37, 1944. pp. 6.

Factors affecting the quality of Ash timber are discussed and the following defects are mentioned as those to be looked for in inspecting Ash:—

1. Inclined or irregular grain; knots, shakes, splits, etc.
2. Discoloration owing to dote (incipient decay); signs of insect attack.
3. 'Brashness' or 'short grain'.
4. Exceptionally narrow or exceptionally wide rings.
5. Rings with less than 50 per cent. of summerwood.
6. Density less than 36 lb. per cu. ft. at 15 per cent. moisture content.

Means by which to distinguish the better grades of Ash in the standing tree are noted. Spring- or summer-felled wood should not have any disadvantage compared with winter-felled wood as long as it is converted or stored under appropriate conditions immediately after felling.

31.8 : 33.8 : 31.2. CLARK, T. Selecting aircraft timber. *B.C. Lumberman* 28 (8), 1944 (25-7, 71-2, 74, 76, 78, 80, 82, 84).

This paper discusses the various factors that should be taken into account in selecting timber for aircraft, such as moisture content and seasoning, method of cutting, strength and other properties, special qualities, defects, etc. [See also *Timberman* 45 (10), 1943-44 (92, 94, 96-8, 100, 102).]

32. HARVESTING OF WOOD. LOGGING

32 : 07.7. GODWIN, G. A plan for woodlands mechanization. Canadian Pulp and Paper Association, Montreal. 1944. pp. 4.

The requirements of the pulp and paper industry in Canada involve intensive investigation into highly specialized equipment design. It is stressed that co-operative effort is necessary for experiments in machine design and in order to interest manufacturers in developing designs of new machine types. A standing committee on mechanization was recently set up within the Woodlands Section of the Canadian Pulp and Paper Association. The first task of the committee will be to conduct a machinery census in order to determine what equipment is actually being used by the industry. The census will also include opinions from all companies on the efficiency of the machine types in use and on improvements desired, and will require from members of the industry comments on specifications for machines which may have to be specially developed for forest operations. The author gives examples of a few machines which, with suitable modifications, could be used under Eastern-Canadian forest conditions. They include light-weight mechanical saws for felling and bucking; small, fast crawler tractors; and special types of wheel tractors and portable rock drills adapted to the requirements of the industry.

32 (44 : 410) : 33.17 : 98.1. LLOYD, A. H. The operations of forestry units in France and Great Britain. *Emp. For. J.* 23, 1944 (10-9 + plates).

An account is given of the formation of the British and Dominion Forestry Companies and of the operations carried out by the British units in France in 1939-40, and by the British and Dominion units in Great Britain during the period 1940-44. Reference is made to the

FOREST UTILIZATION. FOREST TECHNOLOGY

types of sawmill, logging and transport equipment used by the different companies. At the peak of production in the summer of 1943, 63 sawmills were in operation, and the total production of the Military Units from August 1940 to January 1944 was 34 million cu. ft.

32 (66.9) : 33.17 : 76.1 : 31.2 : 12.26-8. WEDDERBURN, L. C. M. Timber exploitation in the Cameroons plantations. *Farm and Forest* 5, 1944 [31-4 (81-4)].

An account is given of the work of timber exploitation in the Cameroons plantations with indications of methods and costs. Iroko (*Chlorophora excelsa*) and Sapele (*Entandrophragma cylindricum*) were the timbers in greatest demand. Latterly, in order to conserve the diminishing stocks, these species and Opepe (*Sarcocephalus diderrichii*) have not been used except when absolutely necessary. *Piptadenia africana* and *Azelia africana* proved to be good substitutes for Iroko for general purposes, while *Staudtia kamerunensis* was excellent for joists, decking and sleepers. Certain species (e.g. *Lophira alata*, *Pterocarpus soyauxii*, *Diospyros bipindensis*, and *Erythrophloeum micranthum*) had to be rejected on account of their excessive hardness.

32.1. Marking of Trees and Coupes

32.1 (485) : 06.5. SCHARD, L. Stämplingstävlingar. En form av skogsvårdspaganda, som med gott resultat provöts i Jämtlands län. [The tree marking competitions. A form of forest conservation propaganda which has been tested with good results in the province of Jämtland.] *Skogen* 30, 1943 (329-31). [Sw.]

Tree-marking competitions are of value in stimulating

briefly with illustrations. This saw is not used extensively on pulpwood operations in the southern States, largely because of the poor results obtained with improper filing and lack of training in its use.

32.21 : 76.4. AMIDON, G. B., and LEBARRON, R. K. To what top diameter can Spruce pulpwood be cut profitably? Canadian Pulp and Paper Association, Montreal. 1944. pp. [4]. [Lake States Forest Exp. Sta.]

In Minnesota, Spruce pulpwood is usually cut in 8- to 8½-ft. bolts with a top diameter limit of 3½-in. inside bark. The main disadvantage in using smaller material is that the mechanical removal of the bark is less efficient, though in the production of wall-board and certain grades of paper a limited quantity of bark is acceptable.

This article describes a study undertaken to determine the costs and yields that would result from cutting pulpwood to different utilization limits, i.e. (1) 8-ft. bolts to 3-5-in. top (standard), (2) 4-ft. bolts to 3-5-in. top, (3) 8-ft. bolts plus one 4-ft. bolt to 3-5-in. top, (4) 8-ft. bolts to 1-5-in. top, and (5) 4-ft. bolts to 1-5-in. top. Closer utilization resulted in increased total production, a lower rate of production, and a higher cost per unit volume. With increased utilization of tops there was an increase in cutting time per cord owing to the greater amount of trimming of branches and the relatively small quantity of wood produced. The cutting of shorter bolts resulted in increased work in sawing and handling. The following table gives the comparative yields and rates of production for each system of utilization.

Utilization system	Yield of wood	Cutting time per cord		Skidding time per cord		Loading time per cord	
	per cent.	hours	per cent.	hours	per cent.	minutes	per cent.
(1)	100-00 ¹	5-55	100-00	1-17	100-00	26	100-00
(2)	102-09	7-77	140-00	1-38	117-95	19	73-08
(3)	102-09	5-68	102-34	1-20	102-56	—	—
(4)	110-37	5-92	106-67	1-20	102-56	— ²	—
(5)	110-95	8-02	145-04	1-37	117-09	— ³	—

¹ The yield and rates of production for standard pulpwood were adopted as the basis for comparison.

² 8-ft. bolts with 1-5- to 3-5-in. top were loaded at the rate of 35 min. per cord.

³ 4-ft. bolts with 1-5- to 3-5-in. top were loaded at the rate of 44 min. per cord.

interest in good management practices. In the competitions described, the competitors mark the same stand, usually about ¼ ha. in size and numbering 200-400 trees. All trees above 4 in. d.b.h. are numbered, corresponding numbers being shown on a form given to each competitor. During the competition a cross is placed against the number of the tree selected for marking. Each competitor is given two of the forms, one to be retained for consultation during the demonstration of the 'ideal marking'. In the 20 competitions that have so far been held in the province of Jämtland the number of entrants has averaged 50 per competition.

R. P. J.

32.2. Felling and Related Operations

32.2 : 07.7. HAWES, E. T., and TRACY, L. Bow saw offers labor-saving possibilities in pulpwood production. *Sth. Pulp Paper J.* 7 (3), 1944 (18-9). [U.S. Forest Service.]

The proper method of filing a bow saw is described

32.25 : 07.7. TICKLE, C. G. English felling axes. *Wood* 9, 1944 (236-7).

This note explains the design and use of the now obsolete English 'dipping axe' (an axe with a long head and narrow blade), and compares it with the English rounding axe and the American axe.

32.25 : 07.7. [GODWIN, G.] The development of portable mechanical saws for the felling and bucking of timber. Canadian Pulp and Paper Association, 3420, University Street, Montreal. 1944. pp. 11.

This article reviews the history of power-saw developments in North America, gives abstracts of the more important papers describing experiments with mechanical saws, and presents a list of manufacturers of power-saws, together with a brief description of the models now commercially available.

32.25.2. RUFF, H. Das Fällen aus der Fallrichtung hängender Stämme. [The felling of leaning trees.] *Forstarchiv* 19, 1943 (246-52). [G.]

FOREST UTILIZATION. FOREST TECHNOLOGY

Advice is given on the felling of trees, with particular reference to the technique to be employed in more difficult cases, such as trees leaning to one side or having a one-sided crown, sturdy Beech and Oak, forked stems, and uphill felling on steep slopes. The advantages of felling close to the ground are enumerated. Good felling technique will result in a minimum of waste, the least possible damage to regeneration and standing trees, and a reduction in the risk of accident.

32.25.5. New hydraulic barker promises important savings. *B.C. Lumberm.* 28 (8), 1944 (44).

A brief description is given of a hydraulic barker, developed by Allis-Chalmers Manufacturing Co., which quickly and cleanly removes bark from logs 4-18 in. in diameter and 4-8 ft. long. It is estimated that, under average conditions, logs can be barked at the rate of 10 cords per hour, based on 90 4-ft. logs per cord. Loss of pulp in barking may be reduced by 10-15 per cent. with the use of this machine.

32.3. Sorting

32.3 : 07.7 : 33.02. RIBERS, U. Lyftkroken—en femtioårig skogens tjänare. Anses som oundgänglig i Norrland, bör införas överallt. [The lifting hook—a fifty-year-old servant of the forest. It is regarded as indispensable in Norrland and should be introduced everywhere.] *Skogsägaren* 20, 1944 (55-6). [Sw.]

An illustrated description of a hook that has been found to be particularly useful in lifting and turning pulpwood. R. P. J.

32.8. Grading and Storage of Wood in the Rough

32.82 : 12.26-8 : 31.42.1 : 32.92. AKINDINOV, M. V. Buk v splave i khiranenii. [Floating and storage of Beech.] *Lesnaya Prom.* No. 12, 1943 (9-11). [Russ.]

[Logs of Beech [presumably *Fagus orientalis*] are floated in Caucasian rivers that are fast and carry a large volume of water. Experience and investigations have shown that the storage of the logs in water is satisfactory, provided all logs are entirely submerged; otherwise they must either be covered with branches or similar material, or they must be irrigated. Storage in piles is practicable in all types of weather given correct irrigation. Inadequate storage leads to sap stain and rot. According to official instructions sap stain is not considered a defect, but the author does not take this view.]

32.82 : 12.26-8 : 31.42.12. VAKIN, A. T. Vlazhnoe khraneniye kak metod bor'by s zad'ykhaniiem bukovoy krevesiny. [Moist storage as a method of controlling sap stain in Beech timber.] *Lesnaya Prom.* No. 12, 1943 (11-4). [Russ.]

Investigations in the Caucasus on Beech [presumably *Fagus orientalis*] have shown that the timber is liable to stain and rot during the period mid-April to October. These defects can be reduced considerably or eliminated by methods of storage that keep the timber in a moist condition. If timber is to be stored for 1-2 months, grading, the coating of the ends of the logs with a protective paint, or a combination of the two methods, often give sufficient protection; for prolonged storage more radical methods, such as the submersion or irrigation of the logs, should be used.

32.9. Transport

32.9 (47.4) : 82. HOHEISEL, A. Grundlagen und Möglichkeiten der Rationalisierung der Waldarbeit im Generalbezirk Lettland. [Bases for, and possibilities of, rationalizing forest work in the Generalbezirk of Latvia.] *Forstarchiv* 19, 1943 (43-55). [G.]

A general discussion of forestry and forest exploitation in Latvia and of possibilities for improving the efficiency of forest labour. It is thought that the improvement of timber extraction to the point at which long-distance transport begins must be regarded for the time being as the principal task, since present extraction methods are primitive and costly.

32.9 (71.8) : 33.02. MARTIN, A. Bundling and transporting four-foot pulpwood in Newfoundland by steamer, railway and trucks. Canadian Pulp and Paper Association, Montreal. 1944. pp. 171.

A discussion of the bundling equipment and technique developed by Bowater's Newfoundland Pulp and Paper Mills, Ltd., to facilitate the transportation of pulpwood cut into 4-ft. lengths. The author describes in some detail the booms used for confining the pulpwood in restricted areas of water called 'holding grounds', the pontoons on which the pulpwood is bundled, the slings used for bundling it and for holding together the bundles during transport, and the cranes by which the pulpwood is loaded from the pontoons to lorries, railway cars, or ships.

32.91.1 : 07.7. BAAK, W. Zieh-, Trage- und Wende-grät nach Oberförster Schüler. [An implement for dragging, carrying and turning [logs, invented] by Chief Forester Schüler.] *Forstarchiv* 18, 1942 (302-4). [G.]

The tool described, which gave very satisfactory results in official tests, is used for the dragging and carrying of logs and poles by a two-man crew and the turning of logs by one man. It weighs 2-2 kg. and consists of (1) a wooden bar 88 cm. long, the ends of which serve as handles, (2) an iron bar 45 cm. long which has a hook at its end and is suspended from the centre of the wooden bar, and (3) a second hook, 25 cm. long, which is hinged on a bolt near the centre of the iron bar. The log is gripped by the two hooks.

32.91.11 : 07.7. SCHANTZ-HANSEN, T. A pulpwood cant hook. *J. For.* 42, 1944 (683-4). [Cloquet Forest Exp. Sta.]

An illustrated description of a cant hook that has been developed for handling large sticks and bolts.

32.91.11 : 32.91.21. LAFORTUNE, J. G. Horses in woods work. *Pulp Paper Mag. Can.* 45, 1944 (321-3).

A discussion of the selection, conditioning and treatment of horses for use in woods operations.

32.91.2. ANTONOFF, G. Schnee- und Eiswege. Winterwege zur Holzaufuhr im europäischen Osten. [Snow- and ice-ways. Winter-ways for wood transport in eastern Europe.] *Forstarchiv* 19, 1943 (185-203). [G.]

The construction, maintenance and use of snow and ice ways are summarized, mainly on the basis of Russian literature. There are over 40 illustrations.

32.92-4 (47.1-6). ANTONOFF, G. Die Flösserei. Grundlagen und Verfahren des Schwimmtransportes des Holzes unter besonderer Berücksichtigung des europäischen Ostens. [Floating and rafting. Principles and methods of transporting wood by floating and rafting with particular reference to eastern Europe.] *Forstarchiv* 18, 1942 (228-71). [G.]

FOREST UTILIZATION. FOREST TECHNOLOGY

A survey of the subject, based chiefly on Russian literature and illustrated by some sixty drawings.

33. CONVERSION AND PRESERVATION OF WOOD

33.0. Utilization-*Categories of Wood*

33.0. GARRATT, G. A. *Wood in war and peace*. *J. For.* 42, 1944 (636-44). [Yale School of Forestry.]

This article describes briefly some of the outstanding developments in wood utilization to meet war-time requirements, with particular reference to construction, plywood, and wood plastics. Post-war aspects of wood products utilization are discussed, and an increase in the over-all use of wood is predicted.

33.06. Fuelwood (including Firewood, Charcoal Wood, and Producer Wood)

33.06 : 33.7 : 33.38. BRATTON, A. W. *The use of wood for fuel*. *J. For.* 42, 1944 (663-7). [Cooperstown (N.Y.) Branch Station, U.S. Forest Service.]

The author discusses the relative advantages and disadvantages of wood for use as a fuel, types of wood-burning heaters, sawdust for domestic heating, industrial and institutional requirements of wood fuel, wood gas, charcoal and briquettes, and fuelwood production and marketing.

33.1. Mechanical Conversion excluding the Manufacture of Mechanical Pulp

33.13. Cooperage. Shingles

33.13. A P I standard for wooden tanks (tentative). American Petroleum Institute, Division of Production. 1943. pp. 8. Chem. Abstr. 38 (3808).

33.15. Manufacture of Veneers and Laminated Wood. Gluing

33.15 : 01.2. Glossary of plywood terms. *W. Cst. Lumberm.* 71 (7), 1944 (84, 86).

33.15. Plywood. *Australian Standard No. (E) 2D*. 804-1943. pp. 6.

33.15 : 12.25. Hoop Pine plywood. *Australian Standard No. (E) D*. 812-1943. pp. 6.

These two standards cover respectively two and three grades of aircraft quality plywood, and have provisions similar to the now superseded British Standard No. 5V3.

33.15 : 12.26-8. More on plywood tubing. *Timber of Canada* 4 (42), 1944 (30, 33, 64-6).

The method used in manufacturing plywood tubing is, in brief, to wind the veneer at right-angles to a mandrel, the veneer being introduced into the mandrel over a strip of resin-impregnated paper; the heat from the mandrel activates the resin. Factors affecting the strength of a given cylinder include: assembly of wood grain, species of wood used, type of resin in impregnated paper, wall thickness of tube, and veneer thickness. Up to the present only the hardwoods Mahogany, Poplar, Birch, Maple, Pecan, Hickory and Sycamore have been used for this purpose.

Possible future uses for plywood tubing are suggested.

33.15 : 31.27. High strength plywood for aircraft. Amendment No. 1 to *British Standard No. 6V3 (PD)*. 266, 1944. p. 1.

Burr is now admitted for Birch and Maple plywood, grades A and B, to the extent shown in an illustration.

33.15 : 38.1. Structural plywood for marine craft. *British Standard No. 1088*, 1944. pp. 23.

Two veneer grades are specified by reference to illustrations of defects, the better grade being used for the face veneers. The species of timber is specified by the purchaser. A test for resistance of the glue to water at 65° C. is obligatory, but no strength test is included.

33.15. Marine plywood. *Australian Standard No. (E) F*. 501-1944. pp. 8.

This standard covers three grades of plywood which may be made from a total of twenty-six alternative species. Quality is high and water resistance tests require immersion in water at 150° F. (65.6° C.) without degrade.

33.15 : 38.1. Reinforced plywood. *Wood* 9, 1944 (192).

A special type of reinforced plywood has been developed by Reinforced Plastics, Ltd., of Queen's Road, Kingston Hill, Surrey. Two wood veneers are interleaved with the reinforcing material which consists of 24 high tensile steel wires per inch interwoven with cotton in both the warp and the weft of the material. This offers no resistance to bending, but by strengthening the outer veneers it facilitates bending without danger of splitting. Complex shapes required in aircraft and boat building are possible with this plywood. It has also been suggested for use in the construction of pre-fabricated houses, furniture, etc.

33.15 : 98.1 (410). Plywood in war-time. Timber Development Association Ltd., 75, Cannon St., London, E.C.4. 1943. pp. [7] + plate.

The present demand for plywood for war requirements leaves only a limited quantity, and only certain types, available for other purposes. This pamphlet notes the types and sizes still obtainable in Britain for general use, and gives technical information to enable the consumer to select suitable plywood for his requirements and to specify and order it correctly. Some notes are given on the care required to prevent deterioration in plywood.

33.15. RITCHIE, J. Production problems in exterior plywood. *Timberman* 45 (10), 1943-44 (34, 36, 38). [Douglas Fir Plywood Association.]

33.15 : 12.25 : 98.1 (73). SMITH, L. F. Production of softwood plywood. *J. For.* 42, 1944 (517).

Output of softwood plywood in thousand sq. ft. (¾-in. basis) for the United States in 1942, 1943 and the first quarter of 1944 is as follows [cf. *For. Abstr.* 6 (61)]:

Year	Total	Moisture resistant	Exterior	Logs consumed thousand bd. ft.
1942	1,840,231	1,569,601	270,630	—
1943	1,494,869	1,190,668	304,201	659,602
1944				
January	121,618	92,420	29,198	52,730
February	121,735	89,291	32,444	53,239
March	136,783	99,856	36,927	58,124

Douglas Fir is the principal species used, followed by Ponderosa Pine.

FOREST UTILIZATION. FOREST TECHNOLOGY

3.15. LONG, J. D. New plastic treatments and finishes for plywood. *Timberman* 45 (10), 1943-44 (32, 34). Douglas Fir Plywood Association.]

3.15 : 31.27. DIETZ, A. G. H., and GRINSFELDER, H. Compressed and impregnated laminated wood. Results of fatigue tests. *Mech. World* 116, 1944 (388). P.R.

Gives briefly the conclusions drawn from a series of tests made to determine the endurance characteristics and fatigue limits of a number of representative types of compressed and impregnated laminated wood, the specimens being placed in a standard rotating beam machine and subjected to a constant bending moment.

3.15. PERBOHNER, S. Manufacture of artificial timber, veneers, or the like. *British Patent* No. 560,929, March 10, 1942. *Brit. chem. physiol. Abstr.* BI, 1944 (271). P.R.

Disintegrated wood is mixed with $MgCO_3$, H_2O , and one or more of such materials as starch, rubber, latex, gums, resins, or vegetable oils, and the mixture is then moulded, pressed, and (kiln-) dried. $NaCl$, Na_2SO_4 , $FeCl_3$, and $FeSO_4$ may be added in small amounts, and also Mg silicate or phosphate, cork, synthetic resins, animal, vegetable, or other fibres, and fungicides, insecticides, or waterproofing agents.

3.15. LASSMARK, J. V. Composite panels or boards of wood or the like. *British Patent* No. 561,860, Feb. 4, 1943. *Brit. chem. physiol. Abstr.* BI, 1944 (272). P.R.

3.15. HOWELLS, T. A., and LEWIS, H. F. The preparation, properties, and uses of paper-base laminates. *Abstr. in Pulp Paper Mag. Can.* 45, 1944 (769-70). [Institute of Paper Chemistry.]

3.15. DELMONTE, J. Wood-cloth and wood-paper laminates. *Trans. Amer. Soc. mech. Engrs.* 66, 1944 (55-9). P.O.

Cloth and paper combined with wood in the manufacture of laminates not only serve as vehicles for the glue but also help to stabilize the wood assemblies and provide structural advantages, as demonstrated by test data given in this paper. Dimensional stability in plywood faced with phenolic-resin-treated cloth and paper is found to be far superior to unprotected plywood.

3.15. Liquid and jelly gelatine glues. *British Standard* No. 6V10, 1944. pp. 4.

Provisions for the use of the $\frac{3}{4}$ -in. thick Beech veneer shear test slip brings this specification into line with other British glue specifications.

3.15. New adhesive. *Sth. Lumberm.* 169 (2120), 1944 (58).

A new synthetic resin adhesive of the phenol-formaldehyde type, known as Amberlite PR-75-B, is being made by the Resinous Products & Chemical Company of Philadelphia. It is a low-temperature curing adhesive for use in plywood bonding and heavy timber lamination.

3.15. HALLS, E. E. A urea formaldehyde glue in powder form. *Plastics* 8, 1944 (406-10). P.R.

3.15. KNIGHT, R. A. G., and DOMAN, L. S. Weathering qualities of plywood glues. *Wood* 9, 1944 (136-40). [Forest Products Research Laboratory, Princes Risborough, Bucks.]

A study was made of the durability, under severe exposure conditions, of a range of plywood adhesives over periods of up to nearly three years. Three exposures were used:—(a) on a wall of south-east aspect;

(b) half buried in the ground; (c) half immersed in water. The following results were noted:—

1. Phenol formaldehyde and urea formaldehyde resins, and urea formaldehyde extended with not more than 25 per cent. of flour, have been found durable in the order named.

2. Urea formaldehyde resins extended with 50 per cent. or more of flour, blood albumin and casein glues, are unsuitable for severe exposures.

3. The addition of low concentrations of certain toxic substances to non-durable glues was found to have only a slight effect on their life.

A working relation between accelerated tests and long-term weathering trials has been established, by which a reasonably accurate judgment can be made of a plywood's worth for use under severe exposure conditions. *From authors' summary.*

3.15. KNOWLES, E. C., and McCoy, F. C. (to The Texas Co.). Plywood binder. *U.S. Patent* No. 2,334,270, Nov. 16, 1943. *Chem. Abstr.* 38 (2772-3). P.R.

Use is made of a composition comprising casein and a resinous distillate obtained in the distillation of a petroleum fraction containing substantial quantities of cyclic constituents and having a $210^\circ F.$ Saybolt furol viscosity of at least 30 sec., the ratio of casein to resinous distillate in the composition being sufficiently high to produce a solid plastic mass when the composition is free from volatile constituents.

3.15 : 31.42.1 : 12.21. KAUFERT, F. H., and RICHARD, C. A. Procedures for measuring the mold resistance of protein glues. Forest Products Laboratory, Madison, Wis., *Mimeo* No. 1344 (revised ed.), 1943. pp. 4 + figs.

3.15. NARAYANAMURTI, D., and SINGH, K. Studies on adhesives. Part IX. Tar-acid-formaldehyde resin adhesives. *Indian For. Leaflet* No. 63, 1944. pp. 19. [Forest Research Institute, Dehra Dun.]

Experiments carried out at the Forest Research Institute, Dehra Dun, indicate that tar acids of Indian origin are suitable for the preparation of resin adhesives. The leaflet describes the results of experiments carried out in the preparation of tar acid-formaldehyde resin adhesives in different forms, their application and cost. The results of strength tests and the gluing characteristics of over 70 species of Indian timbers are also included. *Authors' summary.*

3.15 : 31.2. POWERS, D. H. Effect of synthetic resins on the physical and chemical properties of cellulose and protein fibers. *Abstr. in Pulp Paper Mag. Can.* 45, 1944 (769). [Monsanto Chemical Co.]

3.15. SCHRADER, O. H. Effect of various edge joint glue patterns on bending of glued laminated beams. *Timberman* 45 (9), 1943-44 (56, 58, 60). [Timber Structures, Inc., Speedwall Division, Seattle, Wash.]

Tests on flat laminated beams, in most cases measuring 12 ft. $\times$ 11 in. $\times$ $5\frac{1}{2}$ in. and consisting of eight laminations of kiln-dried, C grade and better Douglas Fir, showed that the position and alignment of edge joints in the laminations has no significant effect on the strength of members of this type. Failures were all typically similar to those obtained in testing solid members.

3.15. LANG, A. A. D., and GERMAN, H. V. Preparation [by 'teasing'] of wooden surfaces for glueing. *British Patent* No. 560,823, Oct. 24, 1942. *Brit. chem. physiol. Abstr.* BI, 1944 (272). P.R.

FOREST UTILIZATION. FOREST TECHNOLOGY

33.15. GRAHAM, P. H. High frequency electrostatic heating of wood. *Veneers and Plywood* 38 (5), 1944 (18-9). P.R.

A brief note is given on the equipment and methods used in high-frequency electrostatic heating, and on the advantages in applying this technique in plywood manufacture.

33.15. TAYLOR, J. P. R-F heating for fabricating wood aircraft. *Electronics* 17 (3), 1944 (108-13). L.S.

A discussion of future possibilities in the application of electronic heating in the manufacture of curved or moulded wood parts for aircraft and in furniture and cabinet production, and the description of a radio-frequency heating set-up used in making wood fuselage rings.

33.15. BROWN, D. W. High frequency heating. *Plastics* 8, 1944 (218-26).

The difference between induction heating method (eddy currents) and the capacity heating method (high frequency) are explained and the theory of each discussed in detail. The apparatus, its principles, and the method of using it, are all described, and the various possible assemblies of 'job' and electrodes, including the 'stray field' method are illustrated. The basic formulae for calculation of power required, voltage and frequency, etc., are given, and methods for overcoming some of the difficulties arising are outlined. The author concludes: "... heatronics (H.F. heating) should not be regarded as the answer to every problem... For thick sections, however, there can be no doubt as to its value'.

33.17. Sawmilling

33.17 : 07.7. HAYCOCK, A. H. The narrow band-saw. *Wood* 9, 1944 (223-6, 260-4).

A discussion of the design, maintenance, and use of narrow band saws. When sawing a thickness greater than 3 in. or so, there is an advantage in having a comparatively large effective tooth pitch; a method suggested for increasing the pitch is to file off the points of two out of every three teeth.

The prevention of saw breakages, the use of guide blocks, and the sharpening and setting of saws are discussed in some detail.

33.17 : 32. TELFORD, C. J. Operating small sawmills in wartime. *Misc. Publ. U.S. Dep. Agric.* No. 509, 1943, pp. 42 + dgms. [Forest Products Laboratory, Madison, Wis.]

Advice is given to operators of small sawmills in the U.S.A., to enable them to secure a maximum of production with limited equipment. Subjects discussed include logging, milling, seasoning, transport of lumber, and sawmill accountancy. The layout of small mills is dealt with in some detail and is discussed in relation to the moving or rebuilding of mills rather than the installation of new equipment.

33.17 (66.4). DUFFELL, R. Sawmilling in Sierra Leone. *Wood* 9, 1944 (255-8).

An account of operations by a Forestry Company of the Royal Engineers. The work in the forests and sawmills is done largely by Africans trained by the British Army.

33.3. Chemical Treatment

33.3 : 31.3. CHALYUK, E. Horse feed from wood.

Lesnaya Prom. No. 9/10, 1942 (11-2). [Russ.] Chem. Abstr. 38 (3741). P.R.

A discussion of the preparation, partial fermentation steaming and storage of cellulosic feeds (as twigs and small branches) for horses, for use in conditions of extreme emergency. Analyses of several trees and bushes are given in terms of protein, fat and cellulose content.

33.32. Pulp and Paper Manufacture. Plastics

33.32. MARK, H. Report on some recent progresses in cellulose chemistry. *Abstr. in Pulp Paper Mag. Can.* 45, 1944 (769). [Polytechnic Institute of Brooklyn.]

33.32. SPURLIN, H. M., MARTIN, A. F., and TENNENT, H. G. Characterization of cellulose derivatives by solution properties. *Abstr. in Pulp Paper Mag. Can.* 45, 1944 (769). [Hercules Exp. Sta., Hercules Powder Co., Wilmington, Del.]

33.32 : 12.25-8 (68) : 31.3. CITTADINI, A. Behaviour of some South African woods on pulping by the Pomilio process. *Österr. Chem.Ztg.* 45, 1942 (193-201). Chem. Abstr. 38 (2818). P.R.

Four South African conifers (*Pinus patula* (I), *P. taeda* (II), *P. insignis* (III), and *P. pinaster* (IV)), and 2 hardwoods (*Eucalyptus saligna* (V) and *Acacia mollissima* (VI)) were pulped by the Pomilio CI process. The ages of woods were: I 6, II 36, III 24, IV 26, V 42, VI 18 years. Analyses of the wood of I-III and V gave: moisture 11-63, 13-88, 12-62, 13-10 per cent.; ash 0-58, 0-44, 0-29, 0-30 per cent.; H₂O solubility 16-80, 2-34, 3-46, 2-17 per cent.; 1 per cent. NaOH solubility 7-29, 10-96, 7-75, 7-99 per cent.; lignin 30-00, 30-84, 31-34, 22-42 per cent.; cellulose and pentosans 45-90, 55-42, 57-16, 67-17 per cent. Pulp yields from the 6 species in the order given above, were 41-44, 37-43, 43, 42-9-44, 46-49-4 and 50-54-9 per cent. Analyses of the pulp produced from I-VI gave the following values: moisture 9-94, 9-88, 11-06, 10-14, 11-22, 9-30 per cent.; ash 0-36, 0-72, 0-76, 0-58, 1-03, 0-67 per cent.; α -cellulose 82-09, 88-8, 88-0, 86-84, 92-22, 89-65 per cent.; hemicelluloses 17-91, 11-16, 12-00, 13-16, 7-78, 10-35 per cent.; Cu no. 2-31, 1-38, 1-00, 2-49, 2-30, 1-16. Data are given also for the various pulping conditions used and the consumption of chemicals. The CI process can be used successfully with these species of wood.

33.32 : 33.15 : 38.1. SMITH, S. L. A survey of plastics from the viewpoint of the mechanical engineer. *Brit. Plastics* 15, 1943 (391-4); 16, 1944 (84-90). P.O.

This paper discusses (1) the characteristics of plastics which affect their behaviour under service conditions, with particular reference to mechanical properties; (2) serviceability of plastics as affected by moisture and corrosion; (3) the use of reinforced plastics as structural materials; (4) the use of plastics in bearings; and (5) the testing of plastics. The materials dealt with include (a) unfilled resins, (b) moulding powders, (c) laminated sheet (paper- and fabric-base), (d) mouldings containing unidirectional fibres, (e) plastics in combination with wood.

33.32 : 12.25 : 34.6. LEWIS, H. F. Plastic developments from Redwood. *Mech. Engng., N.Y.* 65, 1943 (515-7). [Institute of Paper Chemistry, Appleton, Wis.] L.S.

The chemical constituents of Redwood (*Sequoia sempervirens*) are tabulated and discussed briefly, and

notes are given on the composition and physical characteristics of moulding powders, thermoplastic and thermosetting, and plastic pulps made from Redwood waste materials.

33.32 : 38.1 : 34.6. BENNIE, J. Improvement in or relating to the manufacture of wall-boards, slabs or the like. *British Patent* No. 557,371 [n.d.]. *Build. Sci. Abstr.* 17 (n.s.), 1944 (364). P.R.

A method for the manufacture of wall-boards, slabs or the like which includes the steps of mixing together baked sawdust, inert mineral material and a proportion of a binder consisting of alkali silicate, e.g. sodium silicate, and moulding the plastic mass into the article desired.

33.32 : 34.6. BAYON, H. P. Production of compressed or moulded products from wood chips, shavings, sawdust, or the like. *British Patent* No. 559,974, Sept. 16, 1942. *Brit. chem. physiol. Abstr.* BI, 1944 (206). P.R.

33.34. Dyeing and Bleaching of Wood

33.34. Dyeing wood. New method devised by a Finnish engineer. *Timb. Tr. J.* 170, 1944 (402).

A Finnish engineer, E. Estlander, Viiala, has invented a new method of dyeing wood. The wood is dyed right through irrespective of its dimensions. Veneer logs, for instance, can be dyed before cutting. It is thought that the invention will prove important in the joinery and parquet-floor industries, as it will allow of manufacturing floor timber that will not lose its colours through wear. A large dyeing kiln is being built at Viiala, and negotiations are said to be in progress about the export of dyed wood and the sale of patent rights. [See also *Oekonomiska Revue, Oslo* 27 (23/24), 1944.]

33.34 : 12.14.8 : 12.25. LUTTRINGHAUS, H. The dyeing of Redwood fibers. *Rayon Text. Mon.* 24, 1943 (489-90). P.O.

The short fibres of Redwood (*Sequoia sempervirens*) bark have distinct felting properties and are used in combination with wool in the manufacture of fabrics, etc. This paper reports a short study of the affinity of these fibres for various dyestuffs, particularly acid and chrome colours.

33.36. Preservation of Wood. Seasoning and Drying

33.36.1. Preservation against Attack by Plants and Animals

33.36.1 : 33.31. BORGLIN, J. N. (to Hercules Powder Co.). Resin compositions suitable for coating and impregnating wood, paper, metals, plaster or other materials. *U.S. Patent* No. 2,335,908, Dec. 7, 1943. *Chem. Abstr.* 38 (3057). P.R.

33.36.1 : 33.31. BOSTRUM, E. (to Osmose Wood Preserving Co. of America Inc.). Wood preservative. *U.S. Patent* No. 2,344,019, March 14, 1944. *Chem. Abstr.* 38 (3444). P.R.

The debarked wood is coated with a mixture of water-soluble wood preservative and a water-insoluble organic carrier that is toxic, viscous and tacky. Inorganic preservatives are Na, K and NH₄ fluorides, ZnCl₂, Cu₂SO₄, HgCl₂, etc.; organic preservatives, only partially water-soluble, are dinitrophenol, dinitroresol, trinitrophenol, etc. As carriers may be used colloidal clays, e.g. bentonite, diatomaceous earth, etc., in pitch, asphalt, coal tar, etc.

33.36.1 : 33.31. GEWERKSCHAFT KERAMCHEMIE-BERG-GARTEN. Preserving wood. *German Patent* No. 737,743, June 17, 1943. (Cl. 38h. 2.01). *Chem. Abstr.* 38 (4114). P.R.

The wood is impregnated with solutions or emulsions of aromatic sulfofluorides, particularly with benzene- or toluene-sulfofluoride.

33.36.1 : 33.15. ANDERSON, R. B. Finishes for plywood in the aircraft industry. *Mech. Engng. N.Y.* 65, 1943 (506-10). [Industrial Research Division, Wipe-on Corporation, New York, N.Y.] L.S.

The requirements of the ideal finish for this purpose are discussed with reference to moisture resistance, durability to weathering and hard use, weight, ease and speed of application, smoothness and ease of maintenance and refinishing in the field. Of the three types of coatings tested—cellulose, alkyd and phenolic—the phenolic type has proved most satisfactory in meeting requirements up to the present time. Methods of applying aircraft finishes (spray, brush and dip) and precautions to be observed in the finishing operation are discussed briefly.

33.36.1 : 33.53. HULL, P. B. Ground-line treatment prolongs pole service life. *Elect. World, N.Y.* 120, 1943 (638-40). [Public Service Company of Colorado, Denver.] P.O.

Examination of poles 20 months after treatment with Osmose toxic wood preservative showed satisfactory penetration of this material followed by cessation of all fungus growth and decay. The method of applying this treatment is described.

33.36.1 : 33.53. AMADON, C. H. Ground line treatment of standing poles. *Bell. Lab. Rec.* 22, 1944 (468-71). L.S.

The method of treatment was developed for application to standing, untreated poles (mainly Chestnut and Northern White Cedar) which had been in service for some time. The treatment is as follows: (1) the soil around the pole is removed as for inspection purposes and 1 lb. of sodium fluoride is distributed against the exposed butt; (2) the excavation is filled loosely with soil to ground level and a narrow trough is formed around the pole by pressing the loose soil away to a depth of about 10 in.; (3) 1-1½ gal. of creosote are poured around and against the pole to a height of about 18 in. above ground level; (4) the creosote-saturated soil is pressed against the pole and back-filling is completed. Advantages of the treatment are (a) increase in life of the poles, and (b) possible lengthening of the period between inspections of pole lines.

33.36.1 : 33.31. LOSEBY, P. J. A., and KROGH, P. M. D. The persistence and termite resistance of creosote and its constituent fractions. *J.S. Afr. For. Ass.* No. 11, 1944 (26-32).

Small blocks of the sapwood of *Pinus insignis* treated full-cell in a creosote of South African manufacture and in its constituent fractions were exposed to atmospheric conditions for five-and-a-half years. The amount of creosote lost by evaporation and solution was 47 per cent., while losses of the fractions varied from 91 per cent. for that distilling below 270° C. to nil for the residue above 355° C. The loss of creosote from treated wood blocks is compared with that from open dishes.

A similar set of blocks was interred at the site of the International Termite Test at Pienaar's River,

Transvaal. The fractions distilling above 315° C. appeared to give the greatest protection against termites. *Authors' summary.*

33.36.1 : 33.31 : 31.43 : 13.2. LIESE, J., and SEIFERT, L. The testing of the termite-proofness of impregnated wood and other organic materials. *Z. Ver. dtsch. Ing.* 86, 1942 (686-8). *Chem. Zbl.* 1943, I (1345). *Chem. Abstr.* 38 (3442). P.R.

Na pentachlorophenolate (0.5 per cent.) or 0.5 per cent. Nibren wax kills all termites in wood; for other materials unequivocal results have not yet been obtained.

33.36.1 : 33.31 : 31.43 : 13.2. SNYDER, T. E., and ZETEK, J. Effectiveness of wood preservatives in preventing attack by termites. *Circ. U.S. Dep. Agric.* No. 683, 1943, pp. 24. [U.S. Bureau of Entomology and Plant Quarantine.]

Three general classes of wood preservatives are described: (1) preservative oils, such as creosotes and combinations in petroleum or tar, which are specially suitable for the treatment of timber to be used in contact with the ground; (2) water-soluble salts, such as zinc chloride, chromated zinc chloride and several proprietary preservatives, which are normally used for the 'clean' treatment of wood above ground, but which give fair service for timber in contact with the ground when used in concentrations higher than those commercially practicable; (3) certain toxic chemicals which, when dissolved in light petroleum oils, are suitable for the non-pressure immersion treatment of finished articles. Wood treated by the second and third processes is left clean, and after treatment can be finished or painted; wood treated by the third process does not swell or shrink.

The type of treatment (non-pressure or pressure processes) will be determined by the cost and the length of service required. In general, the open-tank method is not so effective as impregnation under pressure. Superficial treatments, such as brushing, dipping, and temporary soaking, add to the life of timber but are not effective permanent treatments for wood to be used in contact with the ground.

A note is given on the treatment of fibre boards during manufacture.

33.36.1 : 33.31 : 12.26-8 : 31.43 : 13.2. WOLCOTT, G. N. How to make wood unpalatable to the West Indian dry-wood termite *Cryptotermes brevis* Walker. II. With organic compounds. *Carib. For.* 5, 1944 (171-80). [E.e.span.]

Most of the constituents of coal-tar creosote were found to be too volatile to be of any value in making wood permanently resistant to attack by *C. brevis*. Those of value in thin dilutions were phenol, phenanthrene, fluoranthene, and pyrene; of these phenol is the only one that is sufficiently abundant and cheap to allow of commercial use. Its value can be increased considerably by synthesizing to penta-chloro-phenol; a 0.5 per cent. petroleum ether dilution of the latter gives permanent protection. Of the natural substances tested, pine oil at 10 per cent. strength does not resist termite attack, while cedar oil and crude cashew-nut shell oil at 5 per cent. strength do. 'Fermate' or ferric dimethyl-dithio-carbamate is permanently resistant at 0.2 per cent. strength, as is ferric chloride at 0.2 per cent. Fe. *From author's summary.* [Cf. *For. Abstr.* 5 (189).]

33.36.1 : 33.31 : 31.43 : 13.2. SCWARZ, L., and REUSCH, A. Boric acid as a preventive against the long-horned beetle, *Hylotrupes bajulus*. *Arch. Hyg., Berl.* 129, 1943 (293-301). *Chem. Abstr.* 38 (3442-3). P.R.

After a short account of the life habits of the timber-destroying beetle, *Hylotrupes bajulus*, of the usual methods of combating the pest, and the requirements of an insecticide for use against this species, boric acid is proposed for use in non-infected or new houses. Its effectiveness combined with its cheapness and low toxicity make it preferable to fluorides. For new houses, saturation of the timber by impregnation is preferred to surface treatment.

33.36.1 : 31.43. HERZIG, J. Different methods of combating the wood-boring beetle, with particular consideration of consumption and depth of penetration of protective liquids in wood. *Bautenschutz* 13, 1942 (57-63, 70-2). *Chem. Zbl.* 1943, I (693). *Chem. Abstr.* 38 (3442). P.R.

Tests on the application of wood preservatives by spraying are reported. Precautions must be taken to avoid occupational poisoning. Three applications by spray are necessary to obtain the depth of penetration possible with two applications by brush.

33.36.1 : 33.31 : 31.42.12. MOOK, P. V., and VERRALL, A. F. Recent tests on sap-stain control. *Sth. Lumberm.* 169 (2118), 1944 (59-61). [Bureau of Plant Industry, Agricultural Research Administration, U.S. Department of Agriculture.]

Preliminary results from recent studies of substitute chemicals for use in sap-stain control were published in *Sth. Lumberm.* 166 (2085) [cf. *For. Abstr.* 5 (48)]. In the present paper further results are given for small-scale tests on Pine and commercial-scale tests on Pine and hardwoods. New chemicals tested in the former were either ineffective in controlling stain or had other undesirable qualities.

In the commercial-scale tests the substitute chemicals giving best promise for sap-stain control were mixtures of borax and the phenolic or mercuric compounds widely used for this purpose. These include two mixtures now marketed under the trade names of Permatox 105 and Noxtane, and other mixtures containing as little as 1 lb. of Dowicide G, 1 lb. Santobrite, or $\frac{1}{4}$ lb. of Lignasan, with 10 lb. of borax to 50 gal. Triple mixtures containing $\frac{1}{4}$ lb. of Lignasan, $\frac{1}{4}$ lb. of Dowicide G and 6 lb. of borax to 50 gal. were also effective. Advantages in using some of the borax mixtures are:—(1) More effective over-all control of stain and moulds; (2) less tendency to skin irritation; (3) reduced consumption of chemicals required for war purposes; (4) lower total dipping cost.

33.36.2. Fireproofing

33.36.2 : 33.31. VAN KLEEK, A. Fire-retardant paints. *Amer. Paint J.* 27 (8), 1942 (48).

33.36.2 : 33.31 : 33.51. OGIEVSKII, V. M. The fireproofing of mine timbers in chalcopyrite mines. *Tsvetnye Metal* 15 (9), 1940 (30-2). *Chem. Zbl.* II, 1941 (1462). *Chem. Abstr.* 38 (2824). P.R.

Mine timbers are best fireproofed by treatment with Na_2HPO_4 , which loses water of crystallization at 20°-100° with absorption of heat such that the wood is not heated; furthermore, in contact with acid mine waters containing Fe it forms insoluble Fe phosphate gels that prevent its leaching out. As antiseptics NaF ,

Na_2CrO_4 , $\text{Na}_2\text{Cr}_2\text{O}_7$, ZnCl_2 , etc. are used; as passivators, H_3PO_4 and H_2BO_3 . Impregnating solutions recommended are 75 parts by weight of water plus (a) 25 parts of $(\text{NH}_4)_2\text{SO}_4$, (b) 20 parts $(\text{NH}_4)_2\text{SO}_4$ and 5 parts borax, or (c) 15 parts $(\text{NH}_4)_2\text{SO}_4$, 3 parts borax, 5 parts Na_2HPO_4 and 2 parts NaF, applied by steaming the wood for 4 hours, subjecting to a vacuum for 1 hour, and treating with the solution at 70° under 10 atm. pressure for 10 hours.

33.36.2 : 33.31. VEIMO, R. Comparative tests of several fireproofing agents for wood. *K. norske vidensk. Selsk. Forh.* 15, 1942 (41-4). *Chem. Zbl.* 1943, I (693). *Chem. Abstr.* 38 (3442). P.R.

Slabs of Spruce wood impregnated by various methods were compared. The spray methods of fireproofing gave better results than other methods.

33.36.3. Seasoning. Drying

33.36.3. TIEMANN, H. D. How wood behaves in drying. *Sth. Lumberm.* 167 (2101), 1943 (51-2); (2103), (53-4); (2105), (281-2); 168 (2107), 1944 (47-8); (2109), (49-50); (2111), (53-4); (2113), (55-6, 58); (2115), (55-6).

Moisture gradients of three types are described, for 'pervious' sapwood and 'impervious' heartwood above fibre saturation point and for lumber below f.s. point. It is shown how the combination of the stresses due to the shrinkage of the outer layers, their increased strength and 'set', may cause casehardening in drying green timber. The moisture gradients of sapwood and impervious heartwood above the f.s. point are markedly different owing to a fundamental difference in the way the 'free' water moves from the centre to the outside. Sapwood is 'pervious' in that the free water is able to 'flow' readily through the cell walls, so that, though the outside may be only slightly drier than the inside, yet water will still move readily from the inner layers. In 'impervious' heartwood, on the contrary, moisture moves slowly and only by diffusion, so that the outer layers of lumber are commonly below the f.s. point while the centre still retains its 'green' condition. Further, a steep moisture gradient between the outside and the inside is necessary to draw off the free water from the inside at anything approaching a reasonable rate.

There is considerable variation in the 'perviousness' of the heartwood of different species, but all drying problems for green lumber depend for solution upon an understanding of these two fundamentally different ways in which the free water moves through the wood. Owing to the ready 'flow' of free moisture, sapwood can easily be dried without the development of great stresses. In impervious heartwood, on the other hand, stress is inevitable in drying wet wood, for the outer layers, having dried below the f.s. point, begin to shrink while the inner layers are still saturated, and this may lead to checking. When drying sapwood, therefore, one should start with a high circulation and a very high humidity; when all the free water is gone, the humidity should be gradually reduced during the removal of the hygroscopic moisture as shrinkage begins. High temperatures are not injurious. For impervious heartwood it is recommended that the humidity to start with should be lower, both to increase the rate of drying and deliberately to 'set' the surface in tension (without, however, causing checking); this should be followed by a rapid drop in the humidity as soon as the shrinkage of

the inner layers changes the tension of the surface layers to a compression; thus drying may be greatly accelerated. Nothing is gained by continuing a high humidity for a long period with a gradual reduction. High temperatures are likely to be injurious. The drying of lumber below its f.s. point is an entirely different problem. No distinction need be made between sapwood and heartwood as moisture moves by diffusion in both, and, as shrinkage takes place all along the gradient, the stresses set up are relatively small.

Above the f.s. point the curve for impervious heartwood is parabolic and that for sapwood a straight line; below the f.s. point both curves become logarithmic. General theories of drying, including attempts to apply Fourier's law of heat diffusion, are discussed. The conclusion is reached that not enough is yet known of the complex theoretical considerations for the elaboration of any simple general rule by which drying time can be definitely determined in advance, except that drying varies inversely as the square of the thickness; experience still provides the best answer.

The use of hygroscopic salts provides an alternative to the usual method of removing moisture by simple surface evaporation. Though in theory this is simple and effective, in practice successful use of the method demands both skill and experience.

33.36.3 : 31.8. Case-hardening in Redwood. *Timberman* 45 (9), 1943-44 (116).

A progress report on research being carried on under the direction of the California Redwood lumber industry indicates that, in the reconditioning of 1-in. kiln-dried Redwood lumber that is to be resawn, a temperature of 170°F . with relatively high humidity will entirely relieve casehardening stresses within 24 hours.

33.36.3 : 33.15. DEICHMÜLLER, F. Elektrisches Trocknen und Leimen von Holz? [Electric drying and gluing of wood?] *Dtsch. Holzbau* 4, 1944 (28-30). [G.] P.R.

It is pointed out that the methods adopted as a result of research on the electric drying and gluing of wood are similar to those that were developed in electric therapy. 33.36.3 : 33.15. REHMAN, M. A., and ISHAQ, S. M. Kiln drying schedule for seasoning of veneers. *Indian For. Leaflet (Utilization)* No. 61, 1943. pp. 7. [Forest Research Institute, Dehra Dun.]

The results of experiments on the kiln drying of veneers of *Mangifera indica*, *Boswellia serrata*, *Sterculia alata*, and *Dalbergia sissoo* are given, and, on the basis of data for the first three species, a schedule for kiln drying veneers of light hardwoods, commonly used for cheap plywoods, is recommended. It is estimated that $\frac{1}{8}$ -in. veneers of most of these woods can be seasoned from green condition to about 8 per cent. content in $2\frac{1}{2}$ -3 hours, and that $\frac{1}{4}$ -in. veneers can be seasoned in about 4 hours, using an efficient modern type of kiln.

33.36.3 : 07.7. Some observations on timber-drying kilns and their proper use. *Leaflet For. Prod. Res. Lab.* No. 36, 1944. pp. 6.

Notes are given on kiln operation, types and grading of kilns, modernization, control equipment and keeping records, piling timber in a kiln, shrinkage, drying times and schedules.

33.36.3 : 33.15. Progressive v. compartment kilns for drying veneer. *Mon. News Lett. Div. For. Prod. Aust.* No. 130, 1944 (2-3).

The advantages and limitations of compartment kilns and progressive (tunnel) kilns for veneer drying are given, and it is concluded that the latter type is the more satisfactory for drying veneers or re-drying plywood.

33.36.3 : 07.7. STEVENS, W. C., HARRIS, P., and PRATT, G. H. A furnace-heated timber-drying kiln. *Wood* 9, 1944 (211-4).

Several attempts have been made in the past to utilize directly the heat produced from burning wood waste for drying timber, but generally the units proved unsuitable when drying English timbers owing to inadequate air movement and lack of proper humidity control in the drying chamber. Some two years ago, when it was particularly desirable to economize in the use of boilers and the staff required to operate them, the Forest Products Research Laboratory produced a design for a kiln that could be run without the aid of a boiler and would utilize sawdust as fuel. An experimental unit was erected at the Home Production Department's sawmill at Denny, Hants. The kiln, its furnace, its humidity-control apparatus, and the method of operation are described with the aid of drawings, and results of tests are presented. The new type of kiln shows considerable promise; it has been found possible to follow, with little expert attention, usual schedules for the drying of softwoods and hardwoods. The furnace acts as an incinerator as well as supplying heat to the kiln. The one serious defect of the present design is that a really high humidity, sufficient for adequate relief of casehardening, cannot be obtained when the timber is dry. Various possibilities for improving the kiln design are discussed.

33.36.3 : 07.7 : 33.15. REHMAN, M. A. Furnace heated veneer drying kiln suitable for the seasoning of veneers for the manufacture of plywood. *Indian For. Leaflet. (Utilization)* No. 57, 1943. pp. 6 + folding plan. [Forest Research Institute, Dehra Dun.]

This leaflet describes the construction (illustrated by a diagrammatic drawing) and operation of an indirect-heated internal-fan furnace kiln suitable for the rapid seasoning of veneer stock. It is estimated that in this kiln veneers of Mango (*Mangifera indica*), $\frac{1}{16}$ -in. thick, can be fully seasoned in about 3 hours.

33.36.3 : 07.7. Quick kiln drying. *Timb. Tr. J.* 171, 1944 (296).

A note on a new type of kiln in which most home-grown timbers may be dried to a moisture content of 12½-15 per cent. in 48 hours. It is claimed that neither the radial, transverse nor tangential sections of the wood fibres are affected by cracks, shakes, etc. Oak may be satisfactorily dried in about 96 hours.

33.37. Distillation. Manufacture of Tar

33.37 : 12.25 (46). MONTERO, J. G. Distillation of the wood of conifers and the products obtained. *Ion* 3, 1943 (553-6). *Chem. Abstr.* 38 (2809). P.R.

An account of the dry distillation of coniferous woods and the products derived therefrom, with special reference to Spanish species.

33.38. Charcoal Manufacture. Use of Wood and Charcoal in Producer-Gas Generators

33.38.1 : 07.7. The construction and operation of charcoal kilns. *Leaflet. For. Prod. Res. Lab.* No. 35, 1944. pp. 11.

Portable steel kilns and a brick kiln that have been developed by the Forest Products Research Laboratory are described in earlier publications [cf. *For. Abstr.* 1 (183); 2 (315); 4 (241); 5 (49-50)]. The object of this leaflet is to summarize and bring up to date information on the design and operation of these kilns.

33.38.1. HELLER, O. Manufacture of charcoal. *British Patent* No. 563,460, 1944. *Fuel Res. Summ.* 7, 1944 (369). P.R.

The method of charcoal manufacture by the continuous carbonization of wood in a carbonizing chamber at high temperature and in an oxygen-free atmosphere, a modicum of that being supplied to the mass of wood in the chamber by hot, oxygen-deficient combustion products initially for starting the carbonization and subsequently for making up losses as by radiation, the heat of exothermic decomposition of the wood itself being utilized to effect carbonization and the exothermal heat being extracted in the distilled vapours.

33.38.1. HELLER, O. Manufacture of charcoal. *British Patent* No. 563,461, 1944. *Fuel Res. Summ.* 7, 1944 (368). P.R.

The method of drying wood for use in the manufacture of charcoal, in which a stream of inert gases controlled to maintain the wood at a temperature of nearly but not more than 270° C. is circulated periodically in opposite directions through the wood so as to prevent the beginning of carbonization.

33.38.2 (67.1-2). AUBREVILLE, M. A. Substitute motor fuels in dark Africa. *Carburants nat.* 3, 1942 (281-7). *Chem. Zbl.* 1, 1943 (236). *Chem. Abstr.* 38 (3107). P.R.

A comprehensive review is given of the use of wood and wood charcoal in gas producers, and the use of vegetable oils in Diesel engines, the gasification of vegetable oils and the use of substitute lubricants in Africa. It was determined that wood is the most valuable raw material in Africa because of the varied ways in which it can be used. Data secured in the tests are presented.

33.39. Manufacture of Sugar, Oils, Alcohol, and Vinegar from Wood

33.39 (73). FAITH, W. L. Development of the Scholler process in the United States. *Abstr. in Pulp Paper Mag. Can.* 45, 1944 (770). [Office of Production Research and Development, War Production Board, Washington, D.C.]

This paper traces the history of the Scholler process for wood saccharification in the United States during the present war. Comparison is made between the Scholler process as operated in Germany and the modified process developed in a pilot plant in the U.S. Factors entering into the economic evaluation of the process are also discussed.

33.39 (73). SHERRARD, E. C., and KRESSMAN, F. W. A review of wood saccharification processes in the United States prior to World War II. *Abstr. in Pulp Paper Mag. Can.* 45, 1944 (770, 772). [Forest Products Laboratory, Madison, Wis.]

The first commercial development in the production of alcohol from wood appeared in the United States about 30 years ago. Throughout the last war and for some years afterward two plants successfully operated in the Southern States, using southern Pine as the raw

material. These operations used the American or one-stage process. In this process wood was hydrolyzed by means of dilute sulphuric acid under steam pressure with the production of sufficient sugar to give about 25 gallons of 95 per cent. ethyl alcohol per ton of dry wood. This conversion was accomplished in 15 minutes, as compared to 16-20 hours required by the original German process for the production of 50 gallons per ton of a similar quality of alcohol.

These American plants were operated in conjunction with large sawmill operations. After World War I, conditions made it impossible for these plants to compete profitably with those producing alcohol from blackstrap molasses.

The same condition held for the production of ethyl alcohol from waste sulphite liquor. From 1914 to 1919 a plant using the Ekstrom process for such production operated continuously and from 1919 to 1938 intermittently, depending upon the price of blackstrap molasses.

With the advent of new materials and better hydrolytic and fermentation techniques, it now appears that both of these processes can hold their own except under very unfavourable economic conditions.

33.39. HARRIS, E. E., BEGLINGER, E., HAJNAY, G. J., and SHERRARD, E. C. Hydrolysis of wood in a stationary digester by successive treatments with dilute sulfuric acid. *Abstr. in Pulp Paper Mag. Can.* 45, 1944 (772). [Forest Products Laboratory, Madison, Wis.]

Cellulose and hemicellulose in wood are hydrolyzed by the action of dilute sulphuric acid at elevated temperatures into simple sugars, some of which may be fermented to produce industrial ethyl alcohol. The hydrolysis proceeds slowly and the simple sugars decompose readily. It is necessary, therefore, to remove the sugars as rapidly as possible after they are formed.

Mill waste from 12 varieties of softwoods, four varieties of hardwoods, and the residue from the solvent extraction of Longleaf Pine (*Pinus palustris*) stumps has been hydrolyzed in a pilot plant in 400-pound charges. Yields of total reducing sugars from softwoods such as Douglas Fir, Spruce and Southern Yellow Pine range from 45 to 57 per cent. of the weight of the wood; from hardwoods such as Oak and Maple 45 to 52 per cent.; and from turpentine-spent chips 35 to 37 per cent. The time required for the hydrolysis and extraction in several instances was as low as 2-7 hours. Sugar concentrations greater than 6 per cent. were obtained without loss in yield. The sugar solutions were neutralized with lime and fermented, producing beers containing as much as 2-9 per cent. alcohol by volume. The yield of alcohol per ton of wood ranged from 40 to 60 gallons per ton of wood from softwoods and 33 to 42 gallons per ton from hardwoods.

33.39. PLOW, R. H., SAEMAN, J. F., TURNER, H. D., and SHERRARD, E. C. Single-stage and multi-stage hydrolysis of wood in the rotary digester. *Abstr. in Pulp Paper Mag. Can.* 45, 1944 (772). [Forest Products Laboratory, Madison, Wis.]

Studies were conducted on the multi-stage hydrolysis of wood, using a 30-inch spherical rotary digester, in an effort to determine whether agitation throughout the cooking cycle was beneficial in increasing yields or decreasing time of reaction compared with those in stationary equipment, whether the rotary digester offered commercial possibilities superior to the

stationary digester, and whether any improvement in yields was possible as a result of modified time, temperature, and acid-concentration schedules.

It was found that agitation has little effect on reaction time, that yields comparable to those from a stationary digester could be obtained only by the use of a higher liquid/solid ratio which resulted in increased steam and acid consumption and gave a more dilute wort. No large increases in yield have yet been obtained by modified cooking schedules.

Attention was then turned to the single-stage hydrolysis of wood. It was found that by introducing modifications indicated by studies of the kinetics of hydrolysis the reaction time could be markedly shortened and yields improved over those obtained in earlier work on single-stage hydrolysis.

It is now possible to obtain yields of more than 20 per cent. fermentable sugar in 5 minutes, exclusive of the time required to raise and lower the temperature. This is a decrease of 60 per cent. in time and an increase of 20 per cent. in yields. It is suggested that new equipment might have to be developed to realize the full possibilities of this technique.

33.39. SAEMAN, J. F., BUBL, J. L., and HARRIS, E. E. Quantitative saccharification of wood and cellulose. *Abstr. in Pulp Paper Mag. Can.* 45, 1944 (752). [Forest Products Laboratory, Madison, Wis.]

A rapid analytical technique has been developed for the hydrolysis of cellulosic materials to reducing sugar in nearly quantitative yields. The method involves the treatment of the material with 72 per cent. sulphuric acid for 45 minutes at 30° C. followed by a secondary hydrolysis for 1 hour in a 15-pound autoclave or for 4 hours at the boiling point.

Data are presented to show how the yield of reducing sugar varies with the conditions used. A table shows the 'potential reducing sugar' content of 15 species of wood and the variation occurring within a species.

33.39. SAEMAN, J. F. Kinetics of the hydrolysis of wood and of the decomposition of sugars in dilute acid at high temperatures. *Abstr. in Pulp Paper Mag. Can.* 45, 1944 (772). [Forest Products Laboratory, Madison, Wis.]

Data are presented to show that wood saccharification involves two reactions: the hydrolysis of cellulose and the decomposition of the resulting sugar. Both reactions were found to be first order and to possess reaction rates of similar magnitude. Constants have been determined to show the dependence of reaction rate on acid concentration and temperature.

On the basis of these kinetic studies, it has been determined that efficiency of conversion of cellulose to reducing sugars increases with increasing temperature and increasing acid concentrations.

The comparative reaction rates of five different species of woods were determined.

33.39 : 31.3. SAEMAN, J. F., HARRIS, E. E., and KLINE, A. Analysis of wood sugars. *Abstr. in Pulp Paper Mag. Can.* 45, 1944 (752). [Forest Products Laboratory, Madison, Wis.]

Experimental work in wood saccharification requires analytical methods for the analysis of reducing sugar, fermentable sugars and alcohol, which are dependable, simple, rapid, and capable of being run in large numbers.

Two methods were used for the determination of reducing sugars—one an electrometric titration method

and the other a micro-method invented by Shaffer and Somogyi.

Fermentable sugars were estimated by determining the amount of sugar absorbed from 1.5 mg. per ml. solution by a 5.0 per cent. yeast suspension.

Alcohol was determined by the specific gravity method, using a Westphal balance with a thermostated container for the beer distillate. It was found that the surface tension error on the wire supporting the bob could be eliminated by the addition of a very small amount of a wetting agent.

33.39 : 34.6. HASCHE, R. L. By-products of wood saccharification. *Abstr. in Pulp Paper Mag. Can.* 45, 1944 (773). [Tennessee Eastman Corporation, Kingsport, Tenn.]

It is generally agreed that, even with the use of waste wood, the process of wood saccharification as a source of alcohol cannot operate at a profit as a peace-time enterprise unless some substantial benefit is obtained from by-products. The purpose of this paper is to discuss the possible utilization of some of the by-products, particularly lignin, and to suggest modifications of the process in order to increase the amount of useful by-products. Comparisons are made between (a) the behaviour of hardwoods and softwoods in the saccharification process, and (b) yields and value of products from wood saccharification and from wood distillation.

33.39 : 12.25-8. PETERSON, W. H. Fodder yeast from wood sugar. *Abstr. in Pulp Paper Mag. Can.* 45, 1944 (773). [Univ. of Wisconsin, Madison, Wis.]

Wood hydrolyzates, prepared by the staff of the Forest Products Laboratory, and representing 20 different species of wood, have been fermented and the yield of yeast determined. About 100 fermentations were run in shake flasks, 40 in 20-litre carboys, 3 in a 150-gallon pilot plant, and 22 in various other types of apparatus. Various factors such as pre-treatment of the hydrolyzate, species and acclimatization of yeast, effect of pH, time, temperature, aeration, and growth factors on yield have been investigated. Best results were obtained with acclimatized strains of *Torula utilis* and *Candida albicans*, these yeasts utilizing both pentoses and hexoses.

Yields (calculated as dry yeast) of from 35 to 40 per cent. of the total reducing sugar in the hydrolyzate were obtained regularly. About 90 per cent. of the apparent reducing sugar was fermented. The remaining 10 per cent. is probably unfermented pentoses and non-sugar reducing substances. Hydrolyzates from Spruce and Southern Pine gave very good fermentations, but those from Douglas Fir were difficult to ferment. Wood sugar from Maple, Yellow Birch and Beech gave results equal to those from the best softwoods.

33.39. LEONARD, R. H., and HAJNY, G. J. Fermentation of wood sugars to ethyl alcohol. *Abstr. in Pulp Paper Mag. Can.* 45, 1944 (772-3). [Forest Products Laboratory, Madison, Wis.]

Experiments demonstrated that the neutralization process markedly affected subsequent fermentations. Investigations on the nature and mode of action of the toxic substances indicate that methods presuming a high oxidation-reduction potential are beneficial. These may be applied either during the pretreatment process or during the fermentation or both. The following points were demonstrated as critical: the pH

of the wort, amount of reduction during pretreatment, yeast strain, cell count, viability, and the method of adding wort to the fermentation. A satisfactory industrial process should employ the following principles: preformed inoculum, a high initial cell count, sterilized equipment, and a rapid fermentation rate.

Application of the schemes proposed for industrial operation was made in the laboratory. Using sugar solutions neutralized with lime and heated in the neutral condition, fermentations were carried out in periods of 10 hours and less. Alcohol yields of 47 per cent. of sugar consumed at concentrations of 2.0 to 2.2 grams per 100 ml. were obtained. Further information was obtained on the beneficial effects of heat on the neutral wort.

33.39 : 34.6. ARIES, R. S. Economic considerations in the production of wood sugars and alcohol. *Abstr. in Pulp Paper Mag. Can.* 45, 1944 (773). [Northeastern Wood Utilization Council, Yale Univ., New Haven, Conn.]

The sources of wood and wood waste suitable for hydrolysis are examined with reference to their quantity, quality, and proximity to present alcohol plants and markets in the United States. The production of cattle and poultry feed is evaluated for areas which import these commodities but possess suitable forest resources.

The economics of the production of alcohol from sulphite waste liquors and wood hydrolysis in relation to alternate methods for its manufacture are given. Figures are presented on the supply and production of molasses, grain, and waste ethylene gases as well as the present and expected uses and demand for alcohol. Contributory factors such as cost of collection and transportation of waste, prices of molasses and sugar, relative yields and problems of disposal of lignin are also taken into account.

These considerations are translated to a national scale in the light of the wartime and expected post-war status of industrial alcohol.

33.7. Firewood (converted)

33.7 (66.9) : 60.31.2. MOHAMMEDU ADELODUN. Firewood supply from Kano farms. *Farm and Forest* 5, 1944 [30(80)].

A large percentage of the firewood used in Kano City is obtained from farm woodlands. Most of the farmers practice a kind of rotation, cutting down old infected or overmature trees and sowing *Dorowa*, (*Parkia oliveri*) in their place. Some naturally established species, like Gawo (*Acacia alba*) and Kurna (*Zizyphus spina-christi*), are also used as fuelwood. Regulations have recently been introduced to check the over exploitation of farm woodlands.

33.8. Other Manufactured Products

33.8 : 33.15. KAHN, S. H. Glued ship timbers. *Wood* 9, 1944 (200).

By means of glue laminations keels of any length or shape can be built up from small pieces of wood. Glues in recent use for this purpose have not been entirely satisfactory, and research on the problem is in progress.

33.8 : 12.26-8 (54). REHMAN, M. A., and CHHEDA LAL. Tests on the suitability of Indian woods for the manufacture of textile and jute mill accessories. Part I.

FOREST UTILIZATION. FOREST TECHNOLOGY

Substitutes for Persimmon and Cornel for cotton mill shuttles. *Indian For. Bull. (n.s.) Utilization No. 121, 1943 (1944).* pp. 9. [Forest Research Institute, Dehra Dun.]

Results from the experiments described show that the light coloured sapwood of *Diospyros melanoxylon* is the best Indian timber so far tested for cotton mill shuttles; this species gives 50 per cent. of the life of the imported timbers Persimmon (*D. virginiana*) and Cornel (*Cornus florida*). Next to *D. melanoxylon* for this purpose are *Ougeinia dalbergioides*, *Acacia arabica* and *Schrebera swietenoides*. Species used locally in shuttle manufacture include *Gardenia latifolia*, *Saccopetalum tomentosum*, Loquat (*Eriobotrya japonica*), *Buxus sempervirens* and *Parrotia jacquemontiana*.

33.8 : 12.26-8 (54) : 33.36.3. REHMAN, M. A. Tests on the suitability of Indian woods for the manufacture of textile and jute mill accessories. Part II. Care and seasoning of wood for bobbins, picker arms, and jute mill rollers. *Indian For. Bull. (n.s.) Utilization No. 122, 1943.* pp. 7. [Forest Research Institute, Dehra Dun.]

Brief notes are given on the methods of seasoning and handling timber for the manufacture of bobbins, picker arms and jute mill rollers, and certain woods indigenous to India are suggested as substitutes for the imported woods used in the manufacture of these articles.

33.9. Grading and Storage of Converted Timber
33.91 : 12.25 : 12.26-8. Official grading rules for Northern (genuine) White Pine, Norway Pine, Jack Pine, Eastern Spruce, Balsam, Aspen, conforming to American lumber standards. Northern Hemlock and Hardwood Manufacturers Association, Ashkosh, Wisconsin. 1941. pp. 48.

34. MINOR FOREST PRODUCTS AND THEIR UTILIZATION

34.2. Vegetable Products

34.2 (43.8 : 47.2-6) : 33.38.1. BUCHHOLZ, E. Die forstlichen Sondernutzungen in den besetzten Ostgebieten und im Sowjetraum. [The special types of forest utilization in the occupied eastern regions and in the Soviet Union.] *Forstarchiv* 19, 1943 (108-20). [G.]

These notes, based on Russian literature, deal with the production of rubber and gutta percha, tannin substances, silk, Birch and Maple syrup, and forest tree seed; the distillation of Pine stumps and the manufacture of charcoal; and the utilization of resin, Lime bast and bark, and of Oak timbers submerged in marshes.

34.21. Fodder Grass and Grazing

34.21 (54) : 97.3. LAURIE, M. V. [Forest grazing, its management and improvement.] Paper (I). *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 11, 1941 (282-94).*

34.21 (54.7) : 97.3. SOTHERS, D. B. [Forest grazing, its management and improvement.] Paper (II). *Forest grazing in Bombay.* With appendices. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 11, 1941 (294-9).*

34.21 (54.8) : 97.3. WILSON, J. A. [Forest grazing, its management and improvement.] Paper (III). *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 11, 1941 (299-301).*

34.21 (54.3) : 97.3. SAGREIYA, K. P. [Forest grazing, its management and improvement.] Paper (IV). *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 11, 1941 (301-2).*

34.21 (54.8) : 97.3. KRISHNASWAMY, K., VENKAT RAO, K. A., and VENKATARAMAIYER, N. [Forest grazing, its management and improvement.] Paper (V). *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 11, 1941 (302-5).*

34.21 (54.2) : 97.3. BAILEY, W. A. [Forest grazing, its management and improvement.] Paper (VI). With summary of debate. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 11, 1941 (305-7, 307-18).*

M. V. Laurie limits the subject to the actual technique of grazing management and improvement, excluding questions of policy and administration directed to the restriction of the grazing incidence. He outlines the different possible methods of improving grazing resources (e.g. periodic or rotational closures, annual burning or fire protection, eradication of weeds etc., introduction of good fodder grasses, control of trees and shrubs for leaf fodder), and discusses the extent of their present application in India. An example is given of the layout and conduct of a grazing experiment based on suggestions by Griffith Davies of the Division of Plant Industry, Australia.

Two schemes of rotational *cum* periodic closures, which are being tried in Bombay, are described by D. B. SOTHERS, who also discusses a draft of revised rules for the regulation of grazing in that Province, recommended by E. A. Garland.

The introduction of grasses of good fodder value and other measures for improving pastures in Madras are described by J. A. Wilson. Grazing systems in force in Mysore are enumerated by K. Krishnaswami, and further information of forest grazing policy and methods of management are given by K. A. Venkata Rao and N. Venkataramaiyer, mention being made of species of fodder trees which are sown on mounds.

It is stated by W. A. Bailey that in the United Provinces improvement of grass production and grazing are definite objects of management in the Afforestation Division. Schemes of rotational and periodic grazing and experiments in improvement of saline areas are described. In some divisions 40-60 per cent. of the area is now regenerated with about a dozen species of trees that can be lopped for fodder. K. P. Sagreiya provides a short note on policy and research in the Central Provinces; this he amplified in debate, differentiating the two main types of experiments likely to be encountered in grazing research, with suggestions and outline of the technique for each.

With regard to research, the Conference agreed that there are two classes of problems:—(a) Those involving indirect methods of utilization and improvement, e.g. harvesting, silage, manuring, burning, introduction of useful exotics; for this class, in which initial comparability of plots is essential, the Central Provinces technique seems promising. (b) Those concerned with direct utilization and improvement through regulated grazing; for this class the uncontrollable variability of the animals and pastures demands a large degree of replication, and the experimental design of Griffith Davies seems to be a suitable basis for evolving an Indian technique.

34.21 (75.6 : 75.8 : 76.2-3) : 97.3. CAMPBELL, R. S., and BISWELL, H. H. *Cattle in the Pines.* *Amer. For. So.* 1944 (238-9, 260, 262, 264-5).

The author claims that the problems of raising livestock in forest areas are by no means unsurmountable, and points out the important contribution made by the

Pine woods of the south-eastern States to wartime cattle production. The value of restricted grazing in keeping down grass competition and reducing the fire hazard is indicated. The opportunities for grazing in a well-managed, fully-stocked forest are limited, but openings which occur naturally or through cuttings, and wide fire lanes can be utilized for this purpose. Further research is, however, necessary in order to find methods adapted for the maintenance of both cattle and trees.

34.21. REID, E. H., and PICKFORD, G. D. An appraisal of range survey methods. *J. For.* 42, 1944 (471-9). [Pacific Northwest Forest and Range Exp. Sta.]

34.24. Tanning Materials. Cork

34.24 : 12.26-8. CHAMBAUD, P. Colonial tanning materials. *Doc. sci. tech. Ind. Cuir* 1942 (7-10). *Chem. Zbl.* I, 1943 (593). *Chem. Abstr.* 38 (3153). P.R.

Bark of *Eucalyptus occidentalis* var. *astringens* contains 27.3 per cent. tannin and 10.6 per cent. non-tannin with 12.2 per cent. moisture. The bark is easily leached and the resulting liquor is clear and contains no sediment. When used alone the tannin penetrates slowly, producing a firm leather, and would therefore be advantageous in heavy leather tanning. The bark of *Eucalyptus occidentalis* var. *citriodora* contains 17.3 per cent. tannin, 7.8 per cent. non-tannin with 10.2 per cent. moisture. Its behaviour on leaching is similar to that of the above described bark. It penetrates slowly and should be of value in tanning upper leather.

34.24 (43.1-5) : 12.14.8 : 12.25. KUNTARA, W., and GRASSMANN, W. Native vegetable tanning materials. IV. Extraction of fresh Pine bark. *Collegium* 1943 (79-86). *Chem. Abstr.* 38 (2519-20). P.R.

Leaching studies were made on bark that had been steamed at 0.25 atm. for 20 minutes, then stored 5-6 weeks, and also on shredded bark that had been treated immediately after shredding by drumming with 1 per cent. of dry NaHSO_3 , then stored for 6-7 weeks in a closed vessel. Better yields were obtained with fresh bark than with dried bark, but less of the chopped fresh bark could be put into an extractor. This resulted in better extraction but more dilute liquors. Shredded, fresh bark leached in cold water yielded 62 per cent. of the tannin.

34.24 (67.5) : 12.26-8. THURIAUX, L. Vegetable tanning materials of Katanga [Belgian Congo]. *Bull. agric. Congo Belge* No. 33, 1942 (279-97); No. 34, 1943 (150). *Brit. chem. physiol. Abstr.* B II, 1944 (267). P.R.

Air-dry barks of the following species contained tans and soluble non-tans in the percentages given: *Brachystegia mpalensis*, 15.2, 10.3; *Pterocarpus delevoiyi* 17.5, 9.3; *Combretum album* 14.6, —; *Combretum* mixed, 10.4, —; *Terminalia* sp. (Bubu) 15.7. Extracts have been prepared from *P. delevoiyi*. The gum of cultivated *Eucalyptus citriodora* and the leaves of cultivated *E. microcoris* contained more than 23 per cent. of tannin (dry basis). Satisfactory practical tanning tests have been obtained. *E. microcoris* is being cultivated by a Special Committee in Katanga.

34.24 (73) : 12.25-8. Prevent tanbark deterioration. U.S. Bureau of Plant Industry, Soils and Agricultural Engineering, 1944. pp. 7.

Practical instructions for the peeling and curing of tanbark.

34.25. Christmas Trees. Medicinal Plants.

Edible Plants

34.25 (74) : 12.25. CROMIE, G. A. A perfect Christmas tree for the northeast. *J. For.* 42, 1944 (529-30).

The Allegheny Fraser Fir (*Abies fraseri*) has a number of characters that favour its use as a Christmas tree; for this purpose it is stated to be superior to Norway Spruce and Douglas Fir.

34.25 : 12.26-8. PRIEST, C. S. Cinchona—its cultivation and extraction. *Aust. J. Pharm.* 24 (n.s.), 1943 (672, 675). L.S.

At the present time nearly all commercial supplies of Cinchona bark are obtained from two species, *Cinchona ledgeriana* and *C. succirubra*. The former species was developed by the Dutch as early as 1820, and within 25 years of its introduction into Java was yielding bark with a quinine content of 11 per cent. or more. Some of the Java barks now yield as much as 16 per cent. of quinine, whereas the average yield of Indian barks is about 5 per cent. *C. ledgeriana* is the most prolific yielder of the quinine-bearing Cinchona species, but it is also the most exacting in its requirements. The quinine content of the bark gradually increases to its maximum over an eight-year period. An outline is given of the method used in extracting the alkaloids.

34.25 : 12.26-8 : 12.11.21 : 23.23.1. MORRISON, B. Y. Quinine from seed. *Agric. in Americas* 3, 1943 (131-3).

An account is given of experiments carried out at the United States Plant Introduction Garden at Gilendale, Maryland, on the raising of Cinchona from seed. Results have shown that the production of Cinchona seedlings presents no special difficulties provided that due attention is paid to certain recommendations on temperature, air, light and soil conditions. Sphagnum moss has proved to be a particularly suitable medium for the seedbed.

34.25 (54) : 12.26-8. CAIUS, J. F. The medicinal and poisonous Lindenblooms of India. *J. Bombay nat. Hist. Soc.* 44, 1943 (92-101). Liv.U.

The medicinal and poisonous Lindenblooms (Tiliaceae) of India belong to four genera: *Corchorus*, *Elaeocarpus*, *Grewia*, and *Triumfetta*. Twenty-three species are listed with brief notes on their distribution, medicinal properties and vernacular names.

34.25 : 12.14.7 : 12.26-8 : 12.11.11. PRITZKER, J., and JUNGKUNZ, R. Beechnuts and Beechnut oil. *Mitt. Lebensm. Hyg., Bern* No. 34, 1943 (107-14). *Chem. Abstr.* 38 (3499). P.R.

It appears that choline, rather than soluble oxalates, is the cause of the poisonous properties of Beechnut residue. Data are given on the composition of pure Beechnut and of unselected material. The oil is edible and resembles sesame oil in composition.

34.26. Resin. Gums. Turpentine. Oils.

Rubber. Latex. Dyestuffs. Sugar

34.26 : 01.4. BÖHME, B. (to Stockholms-Verwertungsgesellschaft m.b.H. and Benjamin Böhme). Resin from resinous wood. *German Patent* No. 716,939, Jan. 8, 1942 (Cl.22h. 1-01). *Chem. Abstr.* 38 (2516). P.R.

Resin is extracted from wood with a mixture of vaporous turpentine and liquid turpentine heated to nearly its boiling point. In a series of connected extraction vessels the turpentine vapours are brought

to act on the wood from beneath and the liquid turpentine from above. The vapours not condensed in one of the vessels are passed on to the next. The resin-turpentine solution is tapped from each vessel, the two are separated and the hot turpentine is returned to the circuit.

4.26 : 12.25 : 12.11.11. WIENHAUS H., and MUCKE, K. *Chemie der Harze*, IV. Mitteil.: Untersuchung des deltanen-Terpentins von *Abies pectinata* DC. [On the chemistry of resins, part IV. Investigation of Silver fir turpentine from *Abies pectinata* DC.] *Ber. dtsch. chem. Ges.* 75, Abteil. B, 1942 (1830-40). [G.] P.R.

Data on the chemical composition of Silver Fir turpentine.

4.26 : 12.25 : 31.3. SANDERMANN, W. *Resins*. IX. Technical methods for the production of [wood] rosin. *Cellulosechemie* 21, 1943 (25-32). *Chem. Abstr.* 38 (2836). P.R.

Statistical data are given regarding rosin production in Germany, Austria, Greece, U.S.S.R., etc., and connecting views regarding rosin extraction are discussed. The investigation with a 60-year-old Pine freshly felled and the wood dried without storage, and with Pine chips, indicated that it was inexpedient to pre-extract the wood, and that the resins could be recovered most economically as tall oil after the sulphate digestion.

It is shown that climate affects the composition of fine extracts. In trees from northern Sweden, the fatty acid content predominated, whereas in German pines, the resin acids predominated. About 12 per cent. of the total fatty acids was lignoceric acid, m. 5-6°. Various methods of purifying both extracted wood rosin and tall oil are discussed.

4.26 : 12.26-8 (81) : 12.11.11. RANGEL, J. L. *Angico um*. [Publ.] *Inst. nac. Tecnol., Rio de J.* 1943. pp.29. *Chem. Abstr.* 38 (2840-1). P.R.

The gum of the Brazilian species *Piptadenia* or *Acacia* contains on the average H₂O 14, arabin 77, tanning material 4.5, cerasine 4 and impurities 0.5 per cent. The solution (1 : 2) is d-rotatory (19°) and of yellow colour. In its qualitative reactions it is distinguished from gum arabic by the facts that borax and sodium carbonate do not precipitate Angico gum and that basic lead acetate gives a slight turbidity only. Formulas for its use as a substitute for gum arabic are given.

4.26 : 13.2 : 12.26-8 : 24.51. CHABRA, B. S. How best to utilize the major lac hosts of Central India. *Indian For.* 69, 1944 (463-8).

The four major lac hosts of Central India which are most utilized for lac cultivation are Kusum (*Schleichera iljuga*), Khair (*Acacia catechu*), Palas (*Butea frondosa*) and Ber (*Zizyphus jujuba*). The author outlines a plan for the working of the trees in order to produce the maximum quantity of high-quality lac.

4.26. TALLANTYRE, S. B. *Essential oils*. *Abstr. in J. proc. R. Inst. Chem. G.B.I.* Part 4, 1943 (142). L.S.

Essential oils may occur, usually in small quantities, in various parts of the plant anatomy. In some species, such as Pines, they are widespread, whereas in others (e.g. Roses) they may be confined to individual organs. Each of the three chief methods used in isolating essential oils, i.e. distillation, expression, and extraction, is briefly reviewed.

4.26 : 12.14.8 : 12.25 : 12.11.11. PAJARI, K. *Untersuchungen über das Kiefernrindenöl II*. [Investigations

of Pine bark oil II.] *Fette u. Seifen* 50, 1943 (506-12). [G.g.] [Zentrallaboratorium der Firma Grosseinkaufsgenossenschaft finnischer Handelsgenossenschaften (S.O.K.) Helsinki, Finland.] L.S.

Data on the physical and chemical properties of Pine bark oil and its constituent substances.

34.26 : 12.26-8 (54.87). CHILD, R., and NATHANAE, W. R. N. *Hydnocarpus oils in Ceylon, part II*. *Trop. Agriculturist, Ceylon* 99, 1943 (140-2). O.R.E.

Data are given on the constitution and properties of the seed oil of *Hydnocarpus anthelmintica* grown in Ceylon. Species reported on in an earlier paper were *H. wightiana* and *H. kurzii* [cf. *For. Abstr.* 5 (271)]. *H. wightiana* is to be preferred to *H. anthelmintica* on account of the better keeping quality and higher oil content of the seeds, and the fact that the oil is more suitable for medicinal purposes. *H. anthelmintica* has a relatively high percentage of shell on the seeds.

34.26 : 12.26-8 (56) : 12.19. GUENTHER, E. *Styrax and oil of Styrax*. *Soap sanit. Chem.* 19 (10), 1943 (33-5, 73). P.O.

Styrax is an aromatic balsam formed by the *Styrax* tree (*Liquidambar*) when the sapwood is injured; it has a wide use in perfumery and certain medicinal preparations. The Asiatic styrax, which is of somewhat lower quality than the American product, is obtained from *L. orientalis*. This tree is a native of southwestern Asia Minor, the most important forests being in a swampy valley near the sea, between Makri and Giova. The exploitation, physico-chemical constants, and chemical composition of Asiatic styrax, and the physico-chemical properties of its oil, are discussed in this paper.

34.26 : 12.26-8 : 23-4. HERRARTE, M. P. *Cultivo de la Hevea brasiliensis*. [The cultivation of *Hevea brasiliensis*.] *Rev. agric., Guatemala* 20 (7/9), 1943 (19-27). [Span.] E.M.B.

A general article with a selected bibliography covering publications in German, French, English, and Russian.

34.26 : 12.26-8 (47.2-6) : 23.4. *Cultivation and breeding of Russian rubber-bearing plants*. Imperial Bureau of Plant Breeding and Genetics, Cambridge, and Horticulture and Plantation Crops, East Malling, England. 1944. pp. 53 + 4.

34.26 : 12.26-8 (47.3). BALANDIN, D. A., and KOLESNIKOV, B. P. K kharakteristike bereskletov primorskovo kraya kak gutaperche nosov. [On the characteristics of the Spindle tree in the Primorski region [E. Siberia] as a rubber-bearing plant.] *Sovetsk. Bot.* No. 4, 1943 (42-54). [Russ.russ.] O.B.D.

34.26 (66.9) : 12.26-8 : 44.3. LAMB, T. R. *The Benin rubber industry—observations made during the survey carried out in 1942*. *Farman Forest* 5, 1944 [35-7(85-7)].

In recent years most of the Para rubber in the Benin Division has been grown from seed in the two-acre yam plots of the small farmer. On the abandonment of the plots the rubber plants have suffered severe competition from the invading bush but many have nevertheless survived. The author discusses and criticizes the commonly-used methods of tapping and of coagulating the latex. Pests and diseases of rubber are comparatively rare in the Division. Some damage is done to young plants by a rodent known locally as the 'cutting-grass', and in the wet season a high percentage of trees in tapping are infected with the tapping panel diseases

of *Ceratostomella* (mouldy rot) and *Phytophthora* (black stripe). The damage done by these fungi is, however, of limited extent, as they are almost invariably killed each year by the prolonged dry season.

Propaganda instituted by the Agricultural Department to reduce latex waste during tapping and to improve the quality of the rubber produced has met with notable success.

34.26 (66.9) : 12.26-8. Rubber in Nigeria. *Bull. imp. Inst., Lond.* 41, 1943 (232-3).

A brief report on the present production of rubber in Nigeria. *Funtumia* rubber production in 1943 was not expected to exceed half of that in 1942, since most of the available trees had been exploited, and second and third tappings yield substantially less than the first tappings. Fair remuneration for the skill required in climbing and cutting rubber-bearing vines, such as *Landolphia owariensis*, together with the relatively low production of rubber per vine, requires that a very much higher price be paid for vine rubber than for rubber obtained from *Funtumia*.

34.26 : 12.26-8. Rubber from plant sources. Investigations on *Cryptostegia*, *Kok-saghyz*, and *Guayule*, with a note on synthetic rubber research. *J. Coun. sci. indust. Res. Aust.* 17, 1944 (49-58). P.R.

34.26 (54.5) : 12-26-8. MOHENDRU, I. D. Work done in 1911 to 1913 by the Punjab Forest Department on *Cryptostegia grandiflora*. *Indian For.* 69, 1943 (460-2). [Silvicultural Research Forest Division, Punjab.]

A summary of work carried out during 1911-13 on *Cryptostegia grandiflora* in the Punjab. Notes are given on the sowing, transplanting and tapping of *Cryptostegia*, on insect and other pests of the plant, and on chemical and mechanical methods of extracting the rubber.

34.26 (729.4) : 12.26-8. FENNELL, T. A. Rubber from Haiti. *Timberman* 45 (5), 1943-44 (30-1, 55-6). [Haitian-American Agricultural Development Corporation.]

A note on the plantations of *Cryptostegia grandiflora* which have been established in Haiti to help meet wartime emergency requirements for natural rubber.

34.26 : 12.26-8 (82). Están muy adelantados los estudios sobre las plantas productoras de latex. [Studies on latex-producing plants are well advanced.] *Maderil* 16 (191), 1944 (25-6). [Span.]

Investigations have been initiated to determine the extent of the Argentinian resources in rubber trees and the prospects for their exploitation. *Sapium haematospermum* is fairly abundant in various localities of the littoral. Analyses of the latex of this tree and vulcanization tests have given satisfactory results.

34.27. Seeds. Fruits. Leaf Fodder. Fibres and Flosses

34.27 : 12.26-8. DUCKWORTH, J. Substitute feeding stuffs. 'Growmore' *Bull. Minist. Agric.* No. 8, 1943. pp. 16. [Rowett Research Institute, Bucksburn, Aberdeenshire.] O.R.E.

A list of emergency feeding stuffs is arranged alphabetically with brief notes on their suitability for use with all classes of stock. They include acorns, Beech mast, hedge clippings, horse chestnuts, Rowan (Mountain Ash) fruits, and the leaves of some trees. It is estimated that fresh leaves of Elm, Ash, Acacia,

Beech, Poplar, Willow, Lime, Hornbeam and Chestnut and similar trees have about two-thirds the feeding value of hay, while dried leaves of these species are somewhat higher in feeding value than average hay.

34.27 : 12.26-8. Acorns, horse chestnuts and Beech mast as feeding stuffs. 'Growmore' *Leaf. Minist. Agric.* No. 39, 1943. pp. [4.] O.R.E.

Advice is given on the use of acorns, horse chestnuts and Beech mast as feeding stuffs for livestock.

34.27 : 12.26-8. BRAUDE, R. The feeding of acorns to pigs. *Agriculture (J. Minist. Agric., Lond.)* 50, 1943 (227-9). O.R.S.

Data are given from experiments carried out by the National Institute for Research in Dairying on the extent to which 'home-dried' acorns can be used in the diet of fattening pigs.

34.27 (68.1) : 12.26-8. BECHUANALAND. Annual report, Forest Department, for year ending 31st December, 1943. [Forest Department, Bechuanaland.] 1944. pp. 3.

Tree species which have been raised for fodder production for the Cattle Improvement Centres are Mesquite (*Prosopis juliflora*), Kurrajong (*Brachychiton populneum*), Belhambrá (*Phytolacca dioica*) and Honey Locust (*Gleditsia triacanthos*).

34.27 : 12.26-8. FRANCIS, W. D. Edible trees and shrubs. 4. The Mulga. *Qd. agric. J.* 58, 1944 (108-10). L.S.

The Mulga (*Acacia aneura*), of which a brief description is given, is one of the most important fodder trees in Australia, being widely distributed and highly palatable to cattle and sheep.

34.27. List of man-made and natural fibers. *A.S.T.M. Stand. text. Mat.* 1943 (356-65). L.S.

Natural fibres are mainly of vegetable origin (seed hair or bast or leaf). This list gives for each fibre plant the common name, botanical name, a brief description and the geographical source.

34.27 : 12.25 (54). BATHAM, H. N. Manufacture of Pine wool. *Bull. U.P. Dep. Ind. Comm.* No. 30 (n.s.), 1942. pp. 5.

A process is described for the conversion of Pine needles into a soft, resilient fibrous product suitable as a packing material for fruits or as a stuffing material for mattresses, cushions, and other upholstery. Results of experiments on the commercial production of this 'Pine wool' are discussed and details are given of the costs of labour and equipment involved.

34.3. Products of the Animal Kingdom

34.3 : 13.2 (71.4) : 91.1. DUGUAY, J. La faune terrestre de la Gaspésie. [The terrestrial fauna of Gaspé.] *For. québec.* 8, 1944 (135-45). [F.]

Notes on animals of interest to hunters and trappers. In Quebec wild life is under the management of the provincial government.

34.6. Utilization of Logging and Milling Waste

34.6 : 33.3 : 09.4. ARIES, R. S. Lignocellulosic residues—a saga of waste. *Abstr. in Pulp Paper Mag. Can.* 45, 1944 (752, 769). [Northeastern Wood Utilization Council, Yale Univ., New Haven, Conn.]

The amount and types of lignocellulosic wastes from forest and agricultural sources are examined in the light of present industrial uses and potential requirements.

FOREST UTILIZATION. FOREST TECHNOLOGY

Chemical conversion is the best answer to the problem, as many of the wastes are just as satisfactory as the high-grade materials which can be used for other purposes.

Figures are given for the amount and kind of non-utilized wood in the mechanical industries and such chemical industries as pulping, distillation, hydrolysis for alcohol, hydrolysis for plastics and fillers, tannin and dye extraction, etc. Statistics are given on the quantities and industrial uses of farm by-products and surpluses, and their potentialities are reviewed from the technico-economic point of view. Evaluation of the relative merits of forest and agricultural wastes suggests that wood residues are the more promising.

Some novel applications of lignin are reviewed with special emphasis upon outlets permitting potential large-scale utilization. Factors such as possible markets, transportation costs, and quality of the material available are examined. The technical and economic conditions affecting the manufacture and sale of chemicals derived from lignocellulosic wastes are considered on a national (U.S.) scale and conclusions drawn with reference to competition from other materials as well as the depletion of some non-renewable resources.

34.6 : 33.32. BAYON, H. P. Production of sheets, panels, and the like from waste wood products. *British Patent* No. 561,489, Nov. 3, 1942. *Brit. chem. physiol. Abstr.* B1, 1944 (271). P.R.

Wood waste (sawdust, chips, shavings, etc.) is dried, mixed (e.g. sprayed) with a liquid artificial or natural resin and/or 15–25 per cent. of a warm liquid phenolic impregnant, e.g. creosote or tar acid, and the mixture is kept at 70° to 80° for about ½-hour and then heat- and pressure-moulded into sheets.

34.6. CORREIA, D. Employment of wood residues. *Rev. brasil. Quim.* 16, 1943 (328–9). *Brit. chem. physiol. Abstr.* B1, 1944 (204). P.R.

A survey of the production from sawdust of $H_2C_2O_4$, EtOH, AcOH, MeOH, and charcoal.

34.6 : 33.06. The utilization of wood waste for steam-raising purposes. *Heat Vent. Engr.* 17, 1943 (200–4). P.O.

Problems relating to the utilization of wood waste for steam-raising purposes are discussed and details are given with illustrations of a complete plant for this purpose.

34.6 : 33.06. DESLER, G. C. Generating steam from waste wood fuel. *W. Cst. Lumberm.* 71 (8), 1944 (46, 95). [Vancouver Plywood and Veneer Company.]

A producer-gas type furnace with two-stage combustion has been used successfully in burning waste-wood fuel having a moisture content in excess of 50 per cent., for purposes of steam generation. Construction and operation of the furnace are described and an analysis given of boiler performance.

34.6 : 12.25 : 32.2 : 33.32 : 34.24 : 12.26–8. FRITZ, E. Changes in utilization practices in the California Redwood section. *W. Cst. Lumberm.* 71 (4), 1944 (100, 102). *Univ. of California, Berkeley, Calif.*

Changes due to war-time requirements are an increased use of species associated with Redwood in upland forests, mainly Douglas Fir and White Fir, and a closer utilization of Redwood itself, particularly in the use of low-grade logs and reduction in breakage loss. Other developments include the use of Redwood waste

material for pulp production, the use of second-growth Douglas Fir for piling, and increased use of the bark of *Lithocarpus densiflorus* for tanning.

38. FOREST CONSTRUCTIONAL WORKS. ENGINEERING

38.1 : 32.29.1 : 23.24. Explosives in agriculture, lumbering, forestry. *Atlas Powder Company, Wilmington, Delaware.* 1942. pp. 60.

Among the subjects dealt with in this bulletin are: (1) the nature of explosives and how to use them; (2) stump blasting; (3) soil blasting, including the use of explosives in relation to tree planting and rejuvenation; (4) gully control with explosives; (5) blasting in connexion with the building of roads for forest operations.

38.1–2 (410). UROUHART, B. P., and NEWMAN, D. Building with round timber. *Wood* 9, 1944 (184–7).

A discussion on the construction of log houses which may prove suitable for many of the larger forest areas in post-war Britain. One of the chief causes of complaint about recently built labourers' and foresters' cottages has been the smallness of the floor and wall space allocated to kitchen, larder, storage room, and out-houses. It is in the provision of larger rooms that the log wall has its greatest advantage. Labour costs vary but little with the length of the log wall, so that with this method of construction a much larger floor area is possible at a given total cost.

38.1–2 : 33.15 : 31.2. HANSEN, H. J. Some fundamentals of timber design. *Bull. agric. mech. Coll. Texas* 13 (5), 1942. *Bull. Texas Engrg. Exp. Sta.* No. 66, 1942, pp. 76. *Build. Sci. Abstr.* 17 (n.s.), 1944 (385). P.R.

This bulletin presents the procedure and the factors governing the use of the fundamental formulas employed in designing both wood and plywood structures. The information is given under the following headings: Characteristics influencing design. Use of working stresses. Control of the effects of shrinkage. Fastenings. Beams. Columns. Members with combined bending and axial loads. Glued laminated construction: limitations in design, moisture content of material, specifications for material and construction, design stresses (with an example), and radial stresses in a curved member are dealt with. The appendix comprises tables giving nail sizes, lag screw sizes, specific gravity of important structural woods, strength properties of different woods, and dimensional properties of American standard sizes of lumber.

38.1–2 : 31.27 : 33.15. MCARD, G. W. Wood in modern construction. *Mech. World* 116, 1944 (227–32). P.R.

A general article on the properties and working qualities of wood available in Britain and on some of the methods which make use of wood in modern construction.

38.2 (410). GREAT BRITAIN. War-time timber economy, no. 5. H.M. Stationery Office, London. 1944. pp. 27 + plates + index.

This publication, which is complementary to 'The standard of war-time building', deals in detail with the practical application of general war-time economy of timber. Suggestions and designs are given for the saving of timber in all types of constructional work.

FOREST UTILIZATION. FOREST TECHNOLOGY

38.2. BOUGHTON, R. V. Prefabricated houses in timber. Ground floor units over surface concrete. *Wood* 9, 1944 (155-7).

The design of pre-fabricated floor units for ground-floor use is discussed.

38.2. HARRISON, J. L. Fireplaces. *Indian For. Leaflet*. No. 62, 1944. pp. 8. [Forest Research Institute, Dehra Dun.]

An outline is given of the general principles involved in the design and construction of an efficient fireplace suitable for forest buildings.

38.3 : 31.27. McCULLOUGH, C. B. Oregon tests on composite (timber-concrete) beams. *J. Amer. Concr. Inst.* 14, 1943 (429-40). P.O.

Tests were made on composite timber-concrete beams as a basis for developing a short-span highway bridge intermediate in cost between the untreated timber trestle and the reinforced concrete viaduct. Results showed *inter alia* that the ultimate strength of a composite beam (of the type tested), suitably designed, is at least twice that for the same materials (and same dimensions) used independently. On the basis of these tests a composite bridge structure has been designed and more than 180 units have been built.

4. FOREST INJURIES AND PROTECTION

4. SCHWERDTFEGGER, F. Die wichtigsten forstpathologischen Arbeiten der Jahre 1938 bis 1942. [The most important works on forest pathology in the years 1938 to 1942.] *Forstarchiv* 19, 1943 (259-70). [G.]

A review of recent literature on forest pathology in general and on damage to forests by fire, smoke, atmospheric agencies, unfavourable soil conditions, fungi, and insects and other animals. 173 references are cited.

42. INJURIES FROM INORGANIC AGENCIES EXCLUDING FIRE

42.2. Temperature Influences

42.21 : 12.14.1. SCARTH, G. W. Cell physiological studies of frost resistance: a review. *New Phytol.* 43, 1944 (1-12). [McGill Univ., Montreal, Canada.] O.B.D.

Frost resistance in plants is dependent primarily upon the morphological and physiological character of the individual cells, and, in particular, upon the nature of the protoplasmic colloids. Underlying the protoplasmic changes which occur during the process of 'hardening,' there are necessarily also physico-chemical changes. Tissues possessing potential resistance are frequently not resistant when in active growth. The three main types of frost injury to plants are due respectively to (1) intracellular freezing, (2) the mechanical effects of freezing and thawing when ice is extracellular, and (3) the physico-chemical effect of dehydration, which appears to be the most common cause of death. The mechanism of resistance to each of these types of injury is reviewed and discussed.

42.21 : 12.26-8 : 45.3 : 13.2. KRAHL-URBAN, J., LIESE, J., and SCHWERDTFEGGER, F. Das Eichensterben im Forstamt Hellefeld. [The dying of Oaks in the forest district of Hellefeld.] *Z. gesamte Forstw.* 76 [70], 1944 (70-86). [G.]

Observations in the Warthe region, where serious damage occurred in 60- to 100-year-old stands. It appears that the damage was a result of the combined action of severe frost during the winters 1939-40 and 1940-41 and of attacks by *Euproctis chrysorrhoea* and *Malacosoma neustria*.

42.21 : 12.26-8 : 45.3 : 13.2. WESTER, H. V. Relation of defoliation by Japanese beetles and drought to frost injury of American Elm. *Proc. Amer. Soc. hort. Sci.* 43, 1943 (316-8). [National Park Service, Washington, D.C.] E.M.B.

Symptoms of frost damage on American Elm (*Ulmus americana*), observed in the city of Washington in the summer of 1942, are believed to have been due to prolongation of active growth into the frost season subsequent to almost complete defoliation by *Popillia japonica* Newm. earlier in the year. Injury was confined to the trunks, particularly to the basal region within 3 feet of the ground.

42.22 : 12.25. SPAULDING, P., and HANSBROUGH, J. R. The needle blight of Eastern White Pine. U.S.D.A. Bureau of Plant Industry [Washington, D.C.], 1943. pp. 2.

The White Pine needle blight usually appears after prolonged periods of cloudy, moist weather which are followed abruptly by dry, hot days, and is more apt to occur when the Pine needles are at their tenderest stage of development. The blight is apparently due to a deficiency of active feeding rootlets, resulting in an insufficient supply of water to the growing needles. Fertilization of affected trees in the dormant season and the retention of a normal layer of fallen dead needles under the trees to form a mulch will help the trees to resume normal growth. Pruning the crown to a size more in proportion to the inadequate root system may also assist the trees to recover from the blight which, however, is seldom fatal.

42.5. Chemical Influences. Nutrient Deficiencies 42.5 : 12.26-8 : 21.32. Verslagen Proefstations. [Experiment Station reports.] *Versl. Landb. Synd., Batavia*, 1940. 1941. pp. 154-282. [Du.] R.A.M. 23 (289-91).

Hevea rubber plants in sand cultures deprived of nitrogen, phosphorus, or sulphur were drastically reduced both in height and girth, a shortage of these elements being manifested earlier than that of potassium, calcium, or magnesium.

43. FOREST FIRES

43.0. Predisposing Factors and Causes

43.0 : 32.29.2. BERNIER, G.-H. La protection des forêts contre l'incendie. Les causes d'incendies forestiers. [The protection of forests against fire. The causes of forest fires.] *For. québec*. 8, 1944 (99-100). [F.]

A note on precautions to be taken in slash-burning operations in connexion with the clearing of land for cultivation.

FOREST INJURIES AND PROTECTION

43.1. Protective Measures

3.1 (71.3-6). HOWIE, E. L. *Forest fire protection in summer operations*. Canadian Pulp and Paper Association, Montreal. 1944. pp. 7.

This paper discusses the action to be taken in preventing forest fires, and in controlling fires that do occur, in connexion with summer logging operations in eastern Canada.

3.11 (66.9). DUNDAS, J. *The burning question*. *Forest and Forest* 5, 1944 [8-10 (58-60)].

After stressing the deleterious effects of bush fires, the author reviews the position with regard to the control of such fires in Nigeria, and compares the legislation in force in Nigeria with similar legislation in Uganda, Sierra Leone, Kenya and Nyasaland. Despite attempts in Nigeria to enforce a policy of early burning, the Burning of Bush Order of 1940 is still largely disregarded except in forest reserves where the systematic clearing of grass early in the dry season has resulted in effective control of bush fires. The author favours annual early burning of all savanna woodland areas, the onus of ensuring that such burning is carried out being placed upon the Native Administration forest staffs who are already accustomed to the annual early burning of forest reserves.

3.11 (71.4) : 07.1 : 32.29.2. BERNIER, G. H. *Cours sur le brûlage des abatis à l'usage des inspecteurs et des gardes-feu*. [Course on slash burning for inspectors and fire-guards.] Service de la Protection, Ministère des Forêts et Forêts, Québec. 1944. pp. 35. [F.]

3.12 : 07.7. McCULLOCH, W. F. *Putting fire 'on the beam'*. *Amer. For.* 50, 1944 (291, 314-5).

Description of a mirror device developed to help in exactly locating a small forest fire after it has been sighted from a lookout tower. The device consists of a primary mirror mounted in a metal frame and turned by clockwork so as to reflect continuously a beam of sunlight on a secondary mirror. The latter is fitted with lights so that it can be oriented accurately on the fire, the sunbeam reflected from it providing a constant reference to those searching for the fire. The upper third of the reflecting mirror has a yellow, and the lower third a red, band. The searcher looking back to the flash sees a yellow light when he is above the fire, a red light when he is below it, and a clear light when 'on the beam'. A field of light 600 by 1,300 ft. is produced at a distance of 5 miles. Within this area is a brilliantly lighted central area of 300 by 1,000 ft. At a distance of 5 miles it is possible even in a smoke haze to locate the centre of the light spot within a 50-ft. square.

3.13 : 07.7. *Pressure and delivery tests of portable forestry power pumpers and trailer pumps*. Forests Commission of Victoria, Australia. 1943. pp. 9 + 8.

3.13 (73). LOVERIDGE, E. W. *The fire suppression policy of the U.S. Forest Service*. *J. For.* 42, 1944 (549-4). [U.S. Forest Service, Washington, D.C.]

Previous to 1935 intensive fire control in the United States was confined mainly to areas of relatively high value, fires in so-called low-value country being only lightly attacked and often allowed to run until extinguished by rain. This resulted in heavy losses, particularly in dry years. Following a meeting of regional foresters and experiment station directors with the Chief Forester in 1935, at which the problem was fully discussed, a new policy was recommended; this requires

that all fires, during possibly dangerous fire weather, must be promptly attacked and suppressed. Results from the application of this policy in all western regions of the United States are indicated in the following comparison of average figures per year:

	1926-34	1935-43
Acreage burned	455,340	141,975
Special suppression costs	\$1,860,026	\$1,954,401

43.13 (485) : 07.7. HJORTH, R. *En effektivare skogsbrand släckning*. [A more effective method for controlling forest fires.] *Skogen* 31, 1944 (171-3). [Sw.]

During the past two years a Forest Fire Control Committee (appointed by the Swedish Forestry Board and the Aerial Protection Inspectorate) has been concerned with improving conditions for fighting forest fires in Sweden both as regards the organization and training of personnel and the development of equipment. The most important results of this work have been published partly as articles and partly as a brochure entitled 'The technique of controlling forest fires in the light of the experience of the Forest Fire Control Committee' (Skogsvårdsföreningens Förlag. Price 25 öre).

In the present paper it is pointed out that the use of foam for controlling forest fires does not appear to have any great advantage compared with water properly used, e.g. to moisten protection belts; these vary in width from $\frac{1}{2}$ to 5 m. and more. Water is applied to the broader belts by means of simple hand pumps; power pumps of Swedish construction will probably be placed on the market shortly. R. P. J.

[See also *Skogsägaren* 20, 1944 (117-20).]

43.3. Fire Damage

43.3 : 52.3 : 12.25. STONE, E. L. *Effect of fire on taper of Longleaf Pine*. *J. For.* 42, 1944 (607).

It is shown that fire and consequent defoliation may cause an appreciable decrease in annual diameter increment at breast height but have little effect on ring width at higher levels, with the result that there is a decrease in stem taper.

43.3 : 12.26-8 : 11.62. SAMPSON, A. W. *Effect of chaparral burning on soil erosion and on soil-moisture relations*. *Ecology* 25, 1944 (171-91). [Univ. of California.]

The burning of a heavy chaparral cover disturbs abruptly the biological and physical equilibrium that existed before the fire. The reaction between the factors favouring the maintenance of a reasonably stable vegetation, and those favouring change in the stability of the soil and the water relations, is accentuated. The degree of change in the habitat will depend chiefly upon climatic factors, character of the vegetation and its rate of regeneration, type of soil, and topography.

The study supports the conclusion that chaparral and its understorey vegetation effectively protect the soil against abnormal erosion, and that this protection may favour relatively high infiltration capacity of the soil.

In general, the data indicate that heavy burning of slopes in excess of about 30 per cent. gradient will accelerate erosion more or less in proportion to the

degree of grazing and trampling. *From author's summary.*

43.3 : 09.4 (71.4). BERNIER, G.-H. La protection des forêts contre l'incendie. Quelques statistiques. [The protection of forests against fire. Some statistics.] *For. québec*. 7, 1944 (319-20). [F.]

Forest-fire statistics for the Province of Quebec for 1943. Some 48,305 acres, or 0.00452 per cent. of the protected forest area, were destroyed or damaged by fire, the total loss being valued at \$121,600. The most important single cause of fires was slash burning (25.6 per cent. of all fires).

43.3 (66). MACDONALD, K. R. The devastation of Africa by fire. *Farm and Forest* 5, 1944 [23-5 (73-5)].

Bush burning has a seriously adverse effect on soil fertility over a great part of Africa. Apart from soil destruction, much damage is caused annually to trees of economic importance through bush fires. The author discusses the effect of such fires and their causes. While a small number may be due to natural causes, by far the largest proportion of bush fires are originated by man, either accidentally or intentionally in clearing virgin or secondary bush for farming purposes, for stimulating the growth of young grass, or for rounding up game. Legislation alone is not sufficient to prevent the evils brought about by bush fires. Active co-operation is required between European and African to reduce to a minimum this serious threat to soil fertility.

43.3 (79.1) : 11.62.1. HENDRICKS, B. A., and JOHNSON, J. M. Effects of fire on steep mountain slopes in central Arizona. *J. For.* 42, 1944 (568-71).

A report on the effect of fire on a mountain watershed in the Sierra Ancha Experiment Forest; elevation ranged from 5,500 to 6,300 ft. and slope from 20 to 82 per cent., 70 per cent. of the area having slopes over 45 per cent. In places the fire destroyed plant cover, litter, and organic matter of the top soil. Heavy soil-erosion losses, equivalent to 32-165 tons per acre, were recorded on the burned area during the summer period immediately following the fire, although no exceptional rain occurred in that period.

43.3 (485) : 12.25. PERRIG, K. A. Zum Waldbrand im Riederhorn- und Aletschgebiet. [On the forest fire in the Riederhorn and Aletsch region.] *Schweiz. Z. Forstw.* 95, 1944 (257-60 + plate). [G.]

Notes on a fire which destroyed some 65 ha. of fine mountain forest. Over 50 per cent. of the stand was Cembran Pine, which burnt in an explosive fashion developing great heat; this is due apparently to the high resin content of the wood of this species. Spruce and Larch proved much more resistant to fire.

44. DAMAGE BY HARMFUL PLANTS.

VIRUS DISEASES

44.1. Forest Weeds

44.1 : 12.26-8 : 12.11.3. UNITED STATES. Annual report of the Allegheny Forest Experiment Station, 1943. Philadelphia, Pa. [1944.] pp. [34].

A marked difference in resistance to the inhibiting effect of grass on survival and growth has been shown by two Poplar hybrids, both having the same female parent (p. 19).

44.3. Fungi

44.3 (410) : 12.21 : 12.25-8. List of common British

plant diseases. Cambridge University Press, 1944. pp. 61. [Plant Pathology Committee of the British Mycological Society.]

This is a revised and enlarged edition of the 'List of Common Names of British Plant Diseases' published in the *Transactions of the British Mycological Society* in 1929. For the first time a preliminary list of tree diseases has been incorporated. The host plants are arranged alphabetically according to the names under which they are best known. Under the name of the host are listed the recommended vernacular names of the diseases which attack it, together with the scientific name of each pathogen. A list of authors' names (with abbreviations), an index of foreign common names, and an index of Latin names are appended.

44.3 (71) : 05.3. CANADA. Twenty-third annual report of the Canadian plant disease Survey, 1943. Dominion Department of Agriculture, Science Service: Division of Botany and Plant Pathology. 1944. pp. xviii + 122.

This report includes a section on the diseases of trees and shrubs. Among the new or noteworthy diseases reported are (1) a heavy aecial infection of crown rust (*Puccinia coronata*) on *Rhamnus cathartica* in Manitoba and (2) leaf spots of Maple (*Acer* spp.) due to *Cylindrosporium pennsylvanicum*, *Phyllosticta minima*, *P. minutisima* and *Phleospora aceris* in eastern Canada.

44.3 (410) : 12.25 : 12.21. GREAT BRITAIN. Nineteenth annual report of the Imperial Forestry Institute academic year 1942-3. University of Oxford. 1943. pp. 12.

Examination of data on butt rot in European Larch (*Larix decidua*) plantations showed that the proportion of sound trees tends, at least locally, to increase with the proportion of total height occupied by the crowns. This suggests that lack of adequate thinning is one of the main reasons for the high proportion of butt rot found in these plantations (p. 6).

What appears to be a local attack of *Melampsora pinitorque* on Scots Pine was discovered in Kent, and an isolated example of *Peridermium cornui* was seen on a Scots Pine (p. 7).

Adelopus gaumanni, one of the causes of needle-cast on Douglas Fir, was found generally distributed in forests throughout Wales, though there was no sign of serious damage occurring (p. 7).

44.3 : 12.25 (75.9) : 12.21. WEBER, G. F. Needle rusts of Pine trees in Florida caused by *Coleosporium* species. *Proc. Fla. Acad. Sci.* 6, 1943 (131-42). L.S.

Each of the eight indigenous Pines of Florida (*Pinus australis*, *P. caribaea*, *P. clausa*, *P. echinata*, *P. glabra*, *P. palustris*, *P. serotina* and *P. taeda*) is susceptible to infection by heteroecious needle-rust fungi of the genus *Coleosporium*. The alternate hosts of the fungi are generally broad-leaved plants, a large number of which belong to the family Carduaceae. Infection of Pine seedlings is widespread in Florida and occasionally severe enough to be of economic importance. Saplings up to 10 ft. in height are also commonly infected, but, as a rule, the disease produces no serious effects at this stage.

The symptoms of needle rust are described and the taxonomy and morphology of the causal fungi are discussed. Attention is drawn to the development of the fungi in relation to their host plants. Control of the disease on Pines can be brought about by the elimination of the alternate host or by spraying with a copper fungicide.

FOREST INJURIES AND PROTECTION

3 : 12.25 : 12.21. SIGGERS, P. V. The brown spot needle blight of Pine seedlings. *Tech. Bull. U.S. Dep. Agric.* No. 870, 1944. pp. 36 + plates. [U.S. Bureau of Plant Industry, Soils and Agricultural Engineering.] Brown spot disease, caused by *Scirrhia acicola*, has been found in the United States on 24 species or varieties of Pines, of which 10 are native to the southeast and 14 occur as exotics in the east. A study of the dissemination of the disease has shown that conidia of the pathogen are disseminated locally by the splashing of rain; the ascospores are dispersed to a large extent by air currents.

The dwarfing effect of brown spot disease on the early growth rate of Longleaf Pine (*Pinus palustris*) seedlings was studied under natural conditions by controlling the disease with fungicides over a period of years. The detrimental effect of severe attacks of the disease on survival of planted seedlings was indicated by greater mortality among unsprayed lots of seedlings in the older demonstration areas. At least three successive annual defoliations were required to weaken seedling sufficiently to cause death. The longer a seedling stand remains dwarfed by the disease the greater the hazard that the stand will be depleted by other adverse factors of the environment. The growth capacity of stunted, diseased Longleaf Pines can be restored by improving the chemical composition of the soil. Single fires during the dormant season greatly reduced the disease during the first season thereafter and to a lesser extent during the second season. Spraying and soil amendments, except under nursery conditions, do not appear economically feasible for controlling brown spot disease. *From author's summary.*

4.3 : 12.25 (54.2) : 12.21. BAGCHEE, K. D. Pathological notes: No. 1. The blister rust menace on Chir. Kumason. The technical description of the rust. *Indian For.* 70, 1944 (323-5 + plate). [Forest Research Institute, Dehra Dun.]

The author records a severe attack of blister rust (*Cronartium himalayense* Bagchee, sp. nov.) on saplings of *Pinus longifolia* in a plantation in the Bhowali ungva. Control of the disease may be brought about by the eradication of *Swertia* spp., the alternate host of the fungus. A description is given of *Cronartium himalayense* (synonyms: *Uredo opheliae* Sydow; *Uredium complanatum* var. *corticola* Barclay; *Uredium himalayense* Bagchee).

4.3 : 12.25 : 12.21. DAY, M. W., and STRONG, F. C. Basal stem canker of Red Pine. *Quart. Bull. Mich. Agric. Exp. Sta.* 26, 1944 (247-9).

Observations on a disease of Red Pine (*Pinus resinosa*) characterized by a stem canker immediately above the roots and near the ground-line which eventually girdles and kills the tree. In a Red Pine plantation in Chipewa, Michigan, where the disease was prevalent, infection was found to be more common in trees growing on poorly-drained sites. The symptoms of the disease and case histories of infected trees suggest that the causal agent is a parasitic fungus (probably a soil-inhabiting species) capable of attacking only trees whose growth has already been impaired by waterlogged conditions. However, no single fungus has been consistently isolated from the cankers.

4.3 : 12.25 : 12.21. EITTLINGER, L. Das Triebsterben der Kiefern und sein Erreger. [The die-back of Pine trees and its agent.] *Ber. schweiz. bot. Ges.* 53, 1943 (59-70). [G.] R.A.M. 23 (200).

Crumenula abietina (*Brunchorstia destruens*) was found to be the agent of a die-back of Pine (*Pinus cembra* and other species) shoots in Alpine afforestation areas. A similar, hitherto unobserved, disease of Larches is referred to *C. laricina*, n.sp. The fungus responsible for a shrivelling of Spruce crowns, described by H. C. Schellenberg in 1906, was identified as *Valsa friesii* and its suspected connexion with *Cytospora pinastri* verified. *B. gibbosa*, hitherto reported once from America, was collected in the Lucerne district.

44.3 : 12.25 : 12.26-8 : 12.21 : 56.04 : 56.05. VANIN, S. I. Fautnost' sosnovykh i berezovykh drevostoev Sverdlovskoy oblasti i ee vliyaniye na vykhod i kachestvo spetsortimentov. [Defects in Pine and Birch stands of the Sverdlovsk region and their influence on the yield and quality of specially valuable assortments of timber.] *Lesnaya Prom.* No. 1-2, 1944 (19-20). [Russ.]

Notes from the report on an expedition to the Urals in 1942-43 under the direction of Professor M. Tkachenko.

In the Sverdlovsk region the most common defect of Pine (*Pinus sylvestris*) is stem rot caused by *Trametes pini*; usually 16-25 per cent. of the stems in a stand bear fruiting bodies of this fungus. The percentage of defective stems is, however, much higher than this, there being many hidden defects commonly caused by *T. pini* and *Polyporus schweinitzii*. The physical properties of wood immediately adjoining a zone infected with *T. pini* do not appear to differ from those of healthy wood; often timber of high quality can be obtained from diseased stems, particularly if no more than one fruiting body is present.

Hidden knots are an important form of defect. In the present investigation there appeared to be a relationship between the height of the first visible dead knot in the tree stem and the extent of hidden knots within the stem; it was found that the yield of high-quality timber increases with the height above ground of the first dead knot up to about 9 m., and declines somewhat if that height is greater than 9 m.

The chief defect in Birch stands was due to *Fomes ignarius*, anything up to 40 per cent. of the stems in a stand being affected. However, this disease does not appear seriously to decrease the yield of high-quality timber.

44.3 : 12.25 : 12.21 : 12.19. FRÖHLICH, J. Über den Befall der Fichte in den Ostkarpaten durch *Trametes pini* Fr. [On the infestation of Spruce in the eastern Carpathian mountains by *Trametes pini* Fr.] *Z. ges. Forstw.* 75 [69], 1943 (152-6). [G.]

T. pini is the most serious disease of old Spruce at intermediate elevations in the eastern Carpathian mountains, where it causes much damage in mixed Beech-Spruce stands. Silver Fir and Beech do very well at these elevations and the cultivation of Spruce should be confined to its natural habitat, at elevations of 1,200 m. or more, where the existing pure Spruce stands are free of disease.

44.3 : 12.25 : 12.21. PRIEHAÜSSER, G. Über Fichtenwurzelfäule, Kronenform und Standort. Beitrag zur Kenntnis der Fichtenrotfäule. [On root rot of Spruce, crown form and site. Contribution to the knowledge of red rot of Spruce.] *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 6, 1943 (259-73). [G.]

A report on conditions observed in a Spruce stand in Bavaria, with suggestions for preventive measures.

FOREST INJURIES AND PROTECTION

The admission of direct sunlight into the stand caused a reduction in soil moisture and the drying out of the roots, which became infested with *Trametes radiciperda*. The growth fell off and the form of the crowns became concave, which appears to have decreased their resistance to snow breakage.

44.3 (67.6) : 12.25 : 12.21. WIMBUSH, S. H. Canker on Monterey Cypress in Kenya. *Emp. For. J.* 23, 1944 (74 + plate).

A disease resembling *Coryneum cardinale* is reported attacking Monterey Cypress (*Cupressus macrocarpa*) in (1) a 9-year-old plantation where root development of infected trees had been hindered by the shallowness of the soil, and (2) fast-growing, 12- and 14-year-old plantations where infection followed damage by Sykes monkeys. Unthrifty and diseased trees have been removed from the plantations, and trial plantings have been made with other species of *Cupressus* which have given indications of immunity to the *Coryneum* fungus in earlier tests made in California. Species showing the best form and growth rate at the end of two years are *C. sargentii*, *C. forbesii*, and *C. sargentii duttonii*.

44.3 : 12.21 : 12.25. NEW YORK. Divisions of Plant Pathology and Seed Investigations. *Rep. N.Y. St. agric. Exp. Sta.* 1942-3 1944 (34-43, 53-8). R.A.M. 23 (327).

Fermate $\frac{1}{2}$ to $\frac{1}{100}$ is more effective than wettable sulphurs against the Cedar rust fungi [*Gymnosporangium juniperi-virginianae* and *G. spp.*] in apple orchards. The combination of micronized sulphur 3-100 and fermate $\frac{1}{100}$ gave excellent results where both scab and Cedar rust were a problem.

44.3 : 12.26-8 : 23.27. HOWARD, F. L., and CAROSELLI, N. E. Tree therapy. *U.S. Patent No.* 2,334,556, Nov. 16, 1943. *Chem. Abstr.* 38 (2785-6). P.R.

A sub-phytotoxic quantity (suitably in dilute aqueous solution) of $(3,3')\text{HCl}\cdot\text{NH}_2\cdot\text{C}_6\text{H}_4\cdot\text{N}=\text{N}\cdot\text{C}_6\text{H}_4\cdot\text{NH}_2\cdot\text{HCl}$ or the like is introduced into a tree, such as a Norway Maple, Beech or Sycamore, for treating pathological conditions caused by toxin-producing pathogens such as those of 'bleeding canker'. A 0.2-0.5 per cent. solution may be used.

44.3 : 12.26-8 : 12.21. DAVIDSON, R. W., and CAMPBELL, W. A. Observations on a gall of Sugar Maple. *Phytopathology* 34, 1944 (132-5).

A description is given of globose or fusiform galls, often bearing one or more cankers, which are fairly common on the trunks of Sugar Maple (*Acer saccharum* Marsh.) in Kane Experimental Forest, Pennsylvania, and adjacent parts of the Allegheny National Forest. Several organisms have been isolated from the central area of discoloration in the interior of the gall, but none has so far been isolated from the advancing margin of diseased tissue. The agency inducing gall formation appears not to be highly virulent, as the increase in the number of galls in a stand takes place at a low rate.

44.3 : 12.26-8 : 12.21. HENRY, B. W. *Chalara quercina* n.sp., the cause of Oak wilt. *Phytopathology* 34, 1944 (631-5).

The causal fungus of the Oak wilt which attacks *Quercus alba*, *Q. borealis*, *Q. coccinea*, *Q. macrocarpa* and *Q. velutina* in Illinois, Iowa, Minnesota and Wisconsin is herein described and the name *Chalara quercina* n.sp. is proposed. *Author's summary.*

44.3 : 12.26-8 : 12.21. HENRY, B. W., MOSES, C. S., RICHARDS, C. A., and RIKER, A. J. Oak wilt: its

significance, symptoms and cause. *Phytopathology* 34, 1944 (636-47).

A wilt disease of Oak reported from Wisconsin and the Upper Mississippi Valley is believed to be caused by a fungus tentatively placed in the genus *Chalara*. The disease is important primarily on the Red Oak group, but various other Oaks, particularly Black Oaks are also attacked. The development of infection appears to have no connexion with site factors, and its spread in woodland has so far been slow. It may be transmitted from one tree to another through anastomosis of the roots of adjoining trees, but since isolated cases of the disease also occur, there must be other means of spread.

The symptoms of the disease on the Red Oak and White Oak groups are described. The fungus was isolated from 116 out of 122 diseased trees. Stem inoculations were successful on 74 trees out of the 90 trees inoculated. [See preceding abstract.]

44.3 : 12.26-8 : 12.21. WALTER, J. M., MAY, C., and COLLINS, C. W. Dutch Elm disease and its control. *Circ. U.S. Dep. Agric.* No. 677, 1943. pp. 12.

A general account of the Dutch Elm disease caused by the fungus *Ceratostomella ulmi*, with reference to characteristics, effects, diagnosis, means of transmission and infection, and the methods that have been developed for its control.

44.3 : 12.26-8 : 12.21. FELT, E. P. Dutch Elm disease control. *Sci. Tree Topics* 1, 1943 (58-64) [Bartlett Tree Research Laboratories, Stamford, Conn.]

Although experience has shown the impossibility of eradicating the Dutch Elm disease entirely, the spread of infection can be greatly reduced by the use of appropriate control measures. The disease is spread by bark beetles, particularly *Scolytus scolytus*, while some trees may be infected through contact with the roots of nearby diseased Elms. The most important step in a Dutch Elm disease control programme is the removal and burning of infected Elm branches or trees before the pathogen can be transmitted to healthy trees by the beetles. Methods of control are outlined.

44.3 (67.8) : 12.26-8 : 12.21. WALLACE, G. B., and WALLACE, M. M. Supplement to the revised list of plant diseases in Tanganyika Territory. *E. Afr. agric. J.* 10, 1944 (47-9).

This supplementary list includes diseases of *Albizia* sp., *Adansonia digitata*, *Cordia holstii*, *Mangifera indica* and *Carica papaya*. To the host plants of *Armillaria mellea* are added *Bauhinia* sp. and *Telfairia pedata*.

44.3 (82) : 12.26-8 : 12.21. PONTIS VIDELA, R. E. E 'mal de la tinta' del nogal en la Republica Argentina [Crown rot of Walnut in Argentina.] *Rev. B.A.P.* 27 1943 (31-3). *Hort. Abstr.* 14 (585).

An account of crown rot (*Phytophthora citrophthora*) of Walnuts, which is becoming prevalent in Argentina. The symptoms are similar to those of Citrus gummosis. The trunk is gradually girdled, the bark lesions may extend far up the tree and downward into the roots for some distance, the leaves turn yellow and the tree may die in a year or two. The Spanish name 'ink disease' is probably derived from the exudate which becomes black on exposure. In some of its macroscopic symptoms the disease resembles melaxuma (*Dothiorella gregaria*) of Walnuts. Taken early, control is fairly simple. The affected parts should be excised, cutting well into the healthy bark, and the wounds disinfected with any

FOREST INJURIES AND PROTECTION

reliable fungicide, such as bordeaux mixture, formalin, etc. The disease is associated with prolonged excess of moisture in the soil. In Argentina it is prevalent in districts where there is no control of irrigation.

44.3 : 12.26-8 : 12.21. DODGE, B. O. Boxwood blights and *Hyponectria buxi*. *Mycologia* 36 (2), 1944 (215-22). R.A.M. 23 (320).

Voluella [*Chaetodochium*] *buxi* and *Verticillium buxi*, associated with the destructive leaf blight or die-back disease of Boxwood [*Buxus sempervirens*], were assumed in a previous study to be simply different types of fructification of the same fungus. Later, however, doubts arose as to the correctness of that view. Unfortunately, the perfect or ascocarpic stage, *Nectriella rousseliana* (Mont.) Sacc., has never been found in nature. On a later occasion, Box leaves infected by *Hyponectria buxi* were found to bear also the white growth of *V. buxi* and sporodochia of *C. buxi*. It is doubtful whether the three forms of fructification are stages of the same fungus, or whether there are two types of leaf blight or die-back, one caused by *H. buxi*, and the other by *Nectriella rousseliana*, both having similar conidial stages. It is suggested that studies of single-spore cultures of both *N. rousseliana* and *H. buxi*, followed by infection experiments, are necessary before the status of *C. buxi* and *V. buxi* can be determined.

44.3 : 12.26-8 : 12.21. Verslagen Proefstations. [Experiment Station reports.] *Versl. Landb. Synd.*, Batavia, 1940, 1941. pp. 154-282. [Du.] R.A.M. 23 (289-91).

Albizia (falcata) is of great importance in the transmission of infection of red root rot of tea (*Ganoderma pseudoferreum*), and the fungus, *Cercospora theae*, which developed in certain tea gardens following the prolonged rains in the early part of the season, consistently originates on *Acacia decurrens* which it completely defoliates before passing on to tea.

44.3 : 12.26-8 : 12.21. CAMPI, M. D. El marchitamiento de la Acacia de Constantinopla (*Albizia julibrissin*) y su relación con la presencia de *Fusarium oxysporum* Schl. f. *perniciosum* (Hepting) Snyder. [The wilt of the Mimosa tree (*Albizia julibrissin*) and its relation to the presence of *Fusarium oxysporum* Schl. f. *perniciosum* (Hepting) Snyder.] *Lilloa* 9, 1943 (457-60 + plate). [Span. e.] A.P.B.

A description is given of wilt symptoms which have been observed since 1938 in trees of *Albizia julibrissin* in the Mercedes locality. The disease, which is frequently fatal, is believed to be caused by *Fusarium oxysporum* Schl. f. *perniciosum* (Hepting) Snyder, a fungus which is recorded in Argentina for the first time. Inoculation experiments have indicated that infection takes place through the roots.

44.3 : 12.26-8 : 12.21 (82). FREZZI, M. J. Muerte del tamarisco, ocasionado por *Botryosphaeria tamaricis* en Corrientes, Argentina. [Death of Tamarisk caused by *Botryosphaeria tamaricis* in Corrientes, Argentina.] *Rev. argent. Agron.* 9, 1942 (110-3). [Span.] R.A.M. 23 (301).

Botryosphaeria tamaricis (Cke) Theiss. & Syd. was isolated from the leaden-coloured, subsequently darkening twigs of Tamarisk (*Tamarix gallica*) in a 1½- to 2-year-old planting at Bella Vista, Corrientes, Argentina, which was entirely destroyed by "e fungus early in 1941, this being the first record for the country. Pycnidia and perithecia are produced in abundance on diseased

material in nature, but no fructifications developed in culture. Positive results were given by inoculation experiments through wounded bark only.

44.3 : 12.26-8 : 12.21. LARGE, J. R. Web blight of seedling Tung trees tentatively identified as the *Rhizoctonia* stage of *Corticium microsclerotia*. *Phytopathology* 34, 1944 (648-9). [Tung Field Laboratory, Bogalusa, Louisiana.]

44.3 : 12.26-8 (922) : 12.21. Verslagen Proefstations. [Experiment Station reports.] *Versl. Landb. Synd.*, Batavia, 1940, 1941. pp. 154-282. [Du.] R.A.M. 23 (289-91).

Generally speaking, the white root-rot fungus (*Fomes lignosus*) predominates in young rubber plantations (up to the age of six or seven years) in West Java, and the agent of red root rot (*Ganoderma pseudoferreum*) in older ones, but in 1940 the former organism was shown to be responsible for large gaps even in long-established gardens. Mildew (*Oidium heveae*) occurred in an unusual form in the inflorescences and on the young leaves of rubber, being accompanied in the former organs by the larvae of the ladybird, *Thea cineta*, which feeds on the fungus. Effective control measures have been used for brown bast, stripe canker (*Phytophthora palmivora*) and pink disease (*Corticium salmonicolor*) causing damage to *Hevea*.

44.4. Virus Diseases

44.4 : 12.26-8. McLEAN, D. M. Histo-pathologic changes in the phloem of American Elm affected with the virus causing phloem necrosis. *Phytopathology* 34, 1944 (818-26).

Phloem necrosis is a virus disease of Elm. The virus is readily transmitted by grafting diseased bark tissue to healthy susceptibles. A natural vector has not been discovered.

Following infection, the fibrous roots die first. Necrosis progresses from the fibrous roots into the larger roots and finally, after death of the roots, the inner phloem in the lower portion of the stem may be killed.

Microscopic pathological changes in the primary phloem tissue of the root include hypertrophied cells and nuclei in the vicinity of mature sieve tubes followed by hyperplasia and finally crushing of the sieve-tube cells and companion cells in the older tissues. Hyperplasia and hypertrophy of parenchyma are the most striking microscopic symptoms in the phloem of older roots and stems.

A yellow to brown discoloration of the phloem tissue accompanies the death of the roots and usually progresses into the stem and lower branches before the tree dies. Associated with the discoloration is a faint odour of wintergreen in freshly cut tissues, which is not detectable in comparable healthy tissues. *Author's summary.*

45. DAMAGE BY ANIMALS

45.1. Mammals

45.12. HENNING, F. W., and AUN, H. Der Elektrozaun als Wildschutz für Forstkulturen. [The electric fence as a measure for protecting forest plantations against wild animals.] *Forstarchiv* 19, 1943 (257-8). [G.]

Preliminary results from a test described in this article indicate that electric fences are effective in excluding deer from plantations.

FOREST INJURIES AND PROTECTION

45.12 : 12.25 : 13.2. Can conifers be protected from deer? *For. Leaves* 34 (2), 1944 (15).

Excellent results have been obtained by spraying foliage with a solution of aluminium sulphate to prevent damage by rabbits. All the tests so far have been carried out in summer, and it is not yet known how effective the treatment will be in winter when food is scarce. It is suggested that a stronger solution of aluminium sulphate might be tried on coniferous seedlings as a protection against browsing by deer.

45.12 : 12.26-8 : 13.2 (74.7) : 13.15. SHADLE, A. R., NAUTH, A. M., GESE, E. C., and AUSTIN, T. S. Comparison of tree cuttings of six beaver colonies in Allegany State Park, New York. *J. Mammal.* 24, 1943 (32-9). [Univ. of Buffalo, Buffalo, N.Y.] O.R.S.

The tree cuttings of six colonies of beavers in Allegany State Park, New York, involving a total for 15 years and 2 months of colony activity are compared. The total cuttings amounted to 5,424 trees, measuring from 1 to 17 inches in diameter. Two genera, *Populus* and *Carpinus*, furnished 56.9 per cent. of the total cuttings. Seven genera in the following order of preference furnished 93 per cent. of the total cuttings—*Populus*, *Carpinus*, *Amelanchier*, *Salix*, *Acer*, *Betula*, and *Prunus*. Eighty-four per cent. of the cut trees were less than 4 in. in diameter. *From authors' summary.*

45.3. Insects

45.3 : 07.7 : 42.21. DAUBERSCHMIDT, Schädlingsbekämpfung durch Flugzeug-Vernebelung. [Pest control by aeroplane with the aid of fogs.] *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 6, 1943 (247-59). [G.]

Since 1937 aerial pest control in Germany has been handled entirely by the Luftwaffe. During the period 1925-43 some 120,000 ha. of forest were dusted from the air, and spraying with liquids was begun in 1939. It is believed that the use of fogs produced by chemical means during flight will be more effective in pest control than either dusting or spraying, and that this method will also prove helpful in preventing frost damage. Poisonous fogs can destroy living organisms, e.g. insects, by acting as contact, stomach, or respiratory poisons. The use of fog substances would economize in aeroplane space, and would permit the use of smaller, simpler, and faster planes. Prevention of frost damage to agricultural crops by the use of fog was tested by the Luftwaffe in 1942 and proved successful. A test carried out in Bavaria showed that it is practicable to fill a forest with fog; further research appears to be promising.

45.3. BECKER, G. Wood-pest control. *German Patent* No. 735,845, April 22, 1943 (Cl. 38h. 3). *Chem. Abstr.* 38 (3106). P.R.

Adult insects are baited with a terpene. Among the most suitable terpenes are pinene, *d*-carvone and phellandrene. The deposited eggs or the larvae are then destroyed by some suitable means.

45.3. MUNRO, J. W. 'D.D.T.': a new insecticide. *Nature, Lond.* 154, 1944 (352-3). [Imperial College of Science and Technology.]

D.D.T., or dichloro-diphenyl-trichloroethane, is an unusually effective insecticide with more uses than any other single substance so far available. Neither the substance itself nor its use as an insecticide is new, but intensive research, since the loss of foreign supplies of pyrethrum and rotenone, has led to important

developments in methods of application. D.D.T. is not capable of replacing rotenone or pyrethrum in all cases. Nevertheless it is of very great value as a general-purpose insecticide. While lacking the rapid action of pyrethrum it has all the good insecticidal qualities of rotenone. Cost will possibly be a factor affecting the sale of D.D.T. in the post-war competitive market.

45.3 (71.1) : 13.2. PREBBLE, M. L. Forest insects in relation to forestry in British Columbia. *B.C. Lumberm.* 28 (6), 1944 (33-4, 48, 50, 52, 54).

After discussing briefly the relative amount of damage caused to forests by insects in Canada and particularly in British Columbia, and the organization that is responsible in Canada for dealing with forest insects, the author describes some of the principal insect pests that cause forest damage and timber deterioration in British Columbia; reference is made to habits, methods of attack, damage, and control. Three groups of insects are considered: bark beetles, defoliators (Hemlock looper, Spruce budworm, and black-headed budworm), and ambrosia beetles (*Trypodendron cavirostris*, *Gnathotrichus sulcatus*, *G. retusus*, *Platypus wilsoni*, and *Xyleborinus tsugae*). The relation between insect control and forest management and utilization is emphasized.

45.3 : 13.2 (74.1). PEIRSON, H. B. Field book of destructive forest insects. Maine Forest Service. 5th ed., 1943. pp. [2] + 26. R.A.E. 32 A(211).

Brief accounts, illustrated by figures, are given of the appearance and biology of 26 insect pests of forests in Maine, together with notes on the damage caused by them and their control. General control measures for different types of insects in forests and on shade trees are summarized, and tables of dilutions for four insecticides are included.

45.3 : 13.2 : 13.15. KURIR, A. Einflüsse abiotischer Umweltfaktoren auf den Schwammsspinner (*Lymantria dispar* L.) im Eistadium während der Winterdiapause. [Effects of abiotic environmental factors on the gipsy moth (*Lymantria dispar*) in the egg stage during the winter diapause.] *Z. ges. Forstw.* 75/69, 1943 (105-32). [G.g.] [Kroatische Univ., Zagreb.]

The experiments described show that exposure of the eggs of *L. dispar* (whether cleaned or not) to the combined action of snow, ice and cold does not have a significant effect on survival. Thus one of the traditional control methods used in Croatia—the scraping of eggs from the trees to the ground in the hope that a high mortality will be caused by atmospheric agencies—lacks all foundation. The experiments also show that eggs of *L. dispar* as well as those of its parasite *Anastatus disparis* survive temperatures as low as -26.0° C.

Observations were made on the hatching of larvae of *L. dispar*.

45.3 : 13.2. SCHWERTFEGGER, F. Über das Auftreten und die Bekämpfung der Kiefernsonnungsgespinstblattwespe (*Acantholyda erythrocephala* L.) in Forleulen-Aufforstungsgebiet des Netze-Warthe-Raumes in den Jahren 1937 bis 1943 nebst grundsätzlichen Bemerkungen zur Entwicklung und wirtschaftlichen Behandlung der dortigen Waldflächen. [On the occurrence and control in 1937-43 of *Acantholyda erythrocephala* L. in the area of the Netze-Warthe region that had been afforested following damage by *Panolis flammea*, together with basic observations on the development and

FOREST INJURIES AND PROTECTION

economic management of the forest therein.] *Z. ges. Forstw.* 76 [70], 1944 (87-97). [G.]

The damage caused by *A. erythrocephala* was extensive and often heavy. Eventually the insect was brought under control by means of repeated applications from the air of arsenical stomach poisons. The ecological conditions which favoured the mass outbreak in this area are discussed.

45.3 (78.6) : 12.25 : 13.2. MILLS, H. B. Montana insect pests, 1941 and 1942. Twenty-ninth report of the State Entomologist. *Bull. Mont. agric. Exp. Sta.* No 408, 1942. pp. 36. R.A.E. 32 A (214-5).

Information of interest on forest insect pests is as follows:—*Harmologa (Archips) fumiferana*, Clem., caused considerable damage to Douglas Fir (*Pseudotsuga taxifolia*), Engelmann Spruce (*Picea engelmanni*) and Alpine Fir (*Abies lasiocarpa*) in the Gallatin Forest in the summer of 1942. Larvae were abundant on 10th July but were not found on 9th August. Parasites reared from them comprised *Glypta fumiferanae*, Viev., and an undescribed species of *Microgaster*.

45.3 : 12.25 (78 : 79) : 13.2. EVENDEN, J. C., BEDARD, W. D., and STRUBLE, G. R. The Mountain Pine beetle, an important enemy of Western Pines. *Circ. U.S. Dep. Agric.* No. 664, 1943. pp. 25. [U.S. Bureau of Entomology and Plant Quarantine.]

The Mountain Pine beetle (*Dendroctonus monticolae* Hopk.) is a serious menace to the Pine forests of the northwestern and Pacific coast states. It attacks many species of Pine throughout its range, and its habits and life cycle are adapted to the requirements of the particular environment in which it occurs. A successful beetle attack results in the death of the infested tree, but there may be several weeks, or even months, between the initial attack by the female beetles and the first evidence of foliage discoloration. Ordinarily attacks are confined to less vigorous trees, but at irregular intervals, under conditions particularly favourable to the beetle, epidemics of *Dendroctonus monticolae* cause widespread and excessive timber losses.

Various environmental factors (including climatic influences and parasitic and predaceous insects) tend to hold infestations in check. Since the death of successfully attacked trees cannot be prevented, direct control measures are directed towards the destruction of the insect broods beneath the bark of infected trees. The particular method of control to be employed depends on bark thickness and on the size of the trees to be treated. Each of the following control measures is briefly discussed: (1) peeling; (2) peeling and burning; (3) decking and burning; (4) burning standing trees; (5) using penetrating sprays; (6) taking advantage of solar heat; (7) mechanical protection by wire mesh screens. The use of repellent sprays has been unsuccessful as a means of protecting trees from beetle attack.

45.3 : 12.25 : 13.2 : 22.83.1. MACALONEY, H. J. The White-Pine weevil. *Circ. U.S. Dep. Agric.* No. 221 (revised ed.), 1943. pp. 31. [U.S. Bureau of Entomology and Plant Quarantine.]

After an account of the range, life history and habits of the White Pine weevil (*Pissodes strobi* (Peck)), the author discusses the tree species most susceptible to attack, the character of the damage done, and the effect of silvicultural and habitat factors on the degree of infestation. The main factors influencing the

density of the weevil population and the amount of injury caused by the insect are (1) the composition and spacing of the stand, (2) the age, height, and vigour of the trees, (3) soil conditions, (4) exposure, (5) climatic factors (chiefly temperature), (6) the availability of food plants, and (7) the action of parasitic and predatory insects, birds, and other animals. Preventive measures such as the use of sprays and repellents, the banding of leaders, picking the weevils by hand or jarring them into nets, and the removal of infected shoots are generally too expensive for use in forest plantations, and are, as a rule, practicable only in the case of ornamental trees or where the value of the stand is particularly high. Weevil infestation is noticeably lower in mixed stands, and the author recommends the planting of suitably dense stands of White Pine in mixture (preferably groupwise) with other species which will be of value in the final crop. A mature, mixed stand of this type will contain fewer White Pines than a pure stand of normal stocking, but the value of the crop as a whole will eventually be greater.

45.3 : 12.25 : 13.2. SCHIMITSCHEK, E. Beobachtungen über *Evtria buoliana* Schiff. und einige ihrer Parasiten. [Observations on *Evtria buoliana* Schiff. and some of its parasites.] *Z. ges. Forstw.* 76 [70], 1944 (36-9). [G.]

Notes on damage to *Pinus sylvestris* and *P. nigra* var. *austriaca* caused by *E. buoliana*, and on parasites of this insect observed at Steinfelde, lower Danube region. It appears that in some localities *E. buoliana* prefers certain races of *P. sylvestris* while neglecting others, and that where both *P. sylvestris* and *P. nigra* var. *austriaca* are present the insect clearly prefers the former species. At Steinfelde *E. buoliana* damaged Austrian Pine stands that had survived a heavy outbreak of *Lophyrus sertifer*.

45.3 (75.7) : 12.25 : 13.2. Controlling Pine beetles in South Carolina woodlands. *Circ. Clemson agric. Coll.* No. 239, 1943. pp. [4].

A description of the type of injury done by Pine beetles with brief instructions for the prevention and control of beetle damage.

45.3 (77.2-6) : 12.25 : 13.2. SECREST, H. C. Damage to Red Pine and Jack Pine in the Lake States by the Saratoga spittle bug. *J. econ. Ent.* 37, 1944 (447-8). [U.S. Bureau of Entomology and Plant Quarantine.]

Serious damage has been caused to natural and planted Red Pine and Jack Pine in the Lake States through the feeding activities of adult spittle bugs, chiefly *Aphrophora saratogensis*. This species, unlike *A. parallela*, feeds on Pines only in the adult stage. Heaviest damage occurs on poor sites where there is an association of Pine and Sweet Fern (*Comptonia peregrina*), a species which appears to be the principal nymphal host in the Lake States.

Injury by the Saratoga spittle bug may best be prevented by silvicultural measures. The introduction of a sufficient number of hardwoods per acre will tend to crowd out Sweet Fern and any other undergrowth species which might act as a nymphal host. Low temperatures are also an important factor in spittle-bug control. It was observed that under experimental conditions 89 per cent. of a series of fifth-instar nymphs of *A. saratogensis* were killed at a temperature of 18° F., while the remainder succumbed at 16° F. The younger nymphs died when the temperature dropped to the low twenties.

FOREST INJURIES AND PROTECTION

Contact insecticides proved ineffective as a means of control.

45.3 : 12.25 : 13.2. FRANCIS, S. H. A report on a visit to the Spruce budworm infested areas with American and Canadian foresters and entomologists. Canadian Pulp and Paper Association, 3420 University Street, Montreal. 1944. pp. 6.

The writer presents the Canadian and American viewpoints on the general history of a Spruce budworm (*Cacoecia fumiferana*) outbreak and discusses possible methods of control under four main headings: (1) parasites, (2) disease, (3) mechanical control, and (4) forest management. The section on mechanical control deals mainly with aeroplane spraying or dusting with the insecticide, D.D.T. The fundamental aspects of forest management which tend to limit budworm infestation are outlined.

45.3 : 12.25 (71.3-4) : 13.2. Canada to renew fight on Spruce budworm. *Paper Tr. J.* 118 (26), 1944 (10). P.R.

Methods being used to control the Spruce budworm, which has caused widespread destruction of Balsam Fir and Spruce in Ontario and Quebec, include spraying the forests with the insecticide D.D.T. by autogyro, and the introduction of the insect parasite *Phytodictus fumiferanae*.

45.3 : 12.25 : 13.2. GREAT BRITAIN. Nineteenth annual report of the Imperial Forestry Institute, academic year, 1942-43. University of Oxford. 1943. pp. 12.

Work was begun on an investigation of *Adelges cooleyi* on Douglas Fir. From a detailed study of individual trees data were obtained on the habits of three Coccinellid predators, *C. 7-punctata*, *Exochomus 4-pustulatus* and *Adalia obliquerata*, and on the parasitism of the first of these by a Braconid parasite (p. 8).

45.3 : 12.25 : 13.2. WILSON, G. F. The Yew scale. *J. R. hort. Soc.* 69, 1944 (244-8 + plate). [Royal Horticultural Society Laboratory, Wisley, Surrey.] O.B.D.

The Yew scale, *Lecanium cornicruidum* Green, was first recorded in England in 1930 from material collected in Crawley, Sussex, in 1928. It appears to be confined at present to the southeastern counties, particularly Surrey and Sussex. The copious honeydew excreted by the insect, together with the growth of sooty moulds upon it, has a more serious effect upon the health of the host plant than does the damage caused by feeding, since this interference with assimilation and respiration leads to premature leaf fall and reduced growth. An outline is given of the appearance and life history of the scale, and suggestions are made for its control.

45.3 : 12.26-8 : 13.2. DONOHUE, H. C. Fumigation of Elm wood containing adult of *Hylurgopinus rufipes* Eich. *J. econ. Ent.* 37, 1944 (452). [U.S. Bureau of Entomology and Plant Quarantine.]

Data obtained from a series of experiments on methyl bromide fumigation as a means of freeing Elm nursery stock from hibernating bark beetles (*Hylurgopinus rufipes*) indicate that such fumigation is effective against the beetles except where the protective Elm bark is particularly thick and corky. In tests for injury with 20 dormant, bare-rooted trees, all but one survived the fumigation treatment, and all but one of the survivors appeared to grow normally the following season.

45.3 : 12.26-8 : 13.2. NEPVEU, P. Les différences de pouvoir parasitaire du Pou de San José (*Quadraspidiotus perniciosus* Comst., Coccidae), selon les végétaux. [The differences of the parasitic power of the San José scale (*Quadraspidiotus perniciosus* Comst., Coccidae) according to the plant hosts.] *C.R. Acad. Sci. Paris* 216, 1943 (612-4). [F.] P.R.

Observations on the survival of the San José scale on various hosts in the Cannes district of France have shown that the host plants of the scale may be divided into three categories: (1) those plants on which the insect develops to the adult stage with a sufficiently low mortality in each generation to bring about a progressive increase (or, at least, no decrease) in the insect population; (2) those plants on which the insect develops to the adult stage, but where the rate of mortality is so high that the insect population tends to decrease progressively; (3) those plants on which female adults have not so far been found, but which may sometimes support a population of male insects.

Examples are given of tree hosts in each category.

45.3 : 12.26-8 : 13.2 (42.1-8). EWER, R. F. Hazel as a food-plant of the comma butterfly larva (Lep. Nymphalidae). *Ent. mon. Mag.* 80, 1944 (213).

A record of feeding by caterpillars of *Polygonia c-album* L. var. *hutchensoni* on *Corylus avellana* L. in Buckinghamshire.

45.3 : 12.26-8 : 13.2 (66.68). BRYANT, G. E. Two injurious species of *Phytophaga* (Halticinae) from the Ivory Coast. *Bull. ent. Res.* 35, 1944 (141-2). [Imperial Institute of Entomology.]

The two species described are *Poëphila flaveola*, sp.n., and *Jamesonia theobromae*, sp.n., the former found on *Onchoba echinata* Oliver, the latter on Cacao leaves.

45.3 : 12.26-8 (79.4) : 13.2. LANGE, W. H. Insects affecting Guayule with special reference to those associated with nursery plantings in California. *J. econ. Ent.* 37, 1944 (392-9).

46. DAMAGE BY MAN

46 : 24.25 : 12.25. HARTELIUS, H. Avverkning av överståndare i ungskog. En undersökning om skadegörelse å plantbestånd. [Cutting down of fillers in young forest. An investigation of injury to the sapling stand.] *Skogsägaren* 20, 1944 (33-5). [Sw.]

From an investigation made in a Pine (*Pinus sylvestris*) stand about 15 years old, and averaging 3m. in height and 12,500 trees per ha., it was found that for every tree felled (40 trees per ha. were removed in the test) an average of 24.2 trees were either injured or killed, thus reducing the stand per ha. by 8 per cent. Injuries were caused by felling (46 per cent.), trimming, etc. (20 per cent.) and transportation (34 per cent.). The investigation showed that injuries caused in removing fillers from a young stand need not be of any great significance if the operation is carefully carried out.

R. P. J.

46 : 23.27. UNITED STATES. Annual report of the Allegheny Forest Experiment Station, 1943. Philadelphia, Pa. [1944.] pp. [34].

Both shellac and asphaltum have been found to have certain disadvantages for use as dressings of tree wounds; lanolin appears to be the best of the materials tested for this purpose. Wounds healed most rapidly when, in addition to the dressing, fertilizers were applied to the base of the tree (pp. 26-7).

5. MENSURATION. INCREMENT. YIELD

52. MEASUREMENT OF TREES AND TIMBER

52.1. Diameter. Girth

52.1-2: 12.25-8 (73) : 21.9. Big trees—1915 and 1943. *J. Hered.* 35, 1944 (88). O.R.S.

A comparison is made between the dimensions of very large trees recorded by the American Genetic Association in 1914 and those included in a list issued in 1943 by the American Forestry Association. The sizes of the largest trees in both lists do not differ greatly. One species outstanding for size, the Chestnut, has virtually disappeared from America in the intervening period. No exotic trees are included in the lists, but the author notes the large dimensions reached by some Eucalypts in California.

52.2. Height. Length

52.2. MICHAŁOFF, I. Zahlenmässiges Verfahren für die Ausführung der Bestandeshöhenkurven. [Numerical procedure for working out curves for stand height.] *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 6, 1943 (273-9). [G.]

The function $n = a'e^{-\frac{b}{x}}$ is stated to be the most suitable for determining the curvilinear regression between height and diameter of stems forming a crop. n = total height of stem less 1.3 metres (height of diameter measurement) and x = diameter of stem at 1.3 m; a and b are constants. Using logarithms the equation takes the form:

$$\log n = \log a - b \log e \frac{1}{x}$$

This is an equation of linear form and is converted by simple substitution into

$$z = A - B$$

by means of which the most probable values of the constants A and B can be calculated, using the method of least and mean squares. After making the necessary calculations over the whole range of diameter classes, using this logarithmic form of the equation, the values enabling the mean curvilinear regression to be drawn are readily obtained. The method of doing this is demonstrated by an example.

52.3. Taper

52.3 : 12.25 : 43.3. ANDERSON, D. A., and BALTHIS, R. F. Effect of annual fall fires on the taper of Longleaf Pine. *J. For.* 42, 1944 (518). [Texas Forest Service.]

Diameter measurements of comparable burned and unburned trees of Longleaf Pine (*Pinus palustris*) indicate that trees subjected to burning tend to develop buttressed trunks, particularly within the first foot above the ground. [Cf. *For. Abstr.* 4 (246).]

52.4. Measurement of Volume

52.4 (485) : 06.1. DJURBERG, G. Virkesmättningsföreningarna och deras arbete. [The timber measuring societies and their work.] *Skogen* 31, 1944 (62-4). [Sw.]

The first timber measuring society in Sweden, Ängermanälvens Tumningsförening, was formed in 1892; by 1936 there were eight such societies. The first societies consisted solely of buyers and only their

interests were represented on the boards of management. Gradually a change was effected and at present the boards of management of all the societies include an equal number of buyers and sellers. The measurers have to work according to explicit instructions and rules as to quality, which are fixed by agreement.

Since 1941 the timber measuring societies have had a central union, the Timber Measuring Council, which deals with questions of common interest. Each society is represented on the Council by two members, a buyer and a seller.

In recent years the authorities have become interested in timber measurement; a law requiring the use of standard rules of measurement and concerned with the right to authorized measurement is now in operation. R. P. J.

52.4 : 92 (485). HAGBERGH, E. Den nya virkesmättningslagstiftningen och dess tillämpning. [The new timber measuring legislation and its application.] *Skogen* 31, 1944 (146-8; 160-2). [Sw.]

Legislation has been enacted in Sweden to ensure that the measurement of timber is done according to recognized standard methods. Provision has been made for the law, which was passed on June 30, 1943, to remain in force up to and including June 30, 1945. The rules by which measurements of assortments are to be made, and to which the law refers, have been issued by the Forestry Board in the form of a circular.

According to a proclamation of December 31, 1943, a buyer or seller of wood may demand that measurement shall be carried out by an authorized timber measurer, though it is not obligatory that every timber measurement which comes under the law should be carried out in this way. All societies of timber-measurers in Sweden have been granted authority to act. R. P. J.

52.43. KRENN, K. Der 'Ernteverlust'. Eine holzmesskundliche Studie, dargestellt an zwei Bestandsbeispielen. ['Loss in harvest'. A study in forest mensuration with examples from two stands.] *Allg. Forst- u. Jagdztg.* 119, 1943 (53-63).

The difference between standing volume and felled volume, as determined by the usual mensurational methods, is shown to be due mainly to deviations from the true volume as a result of the methods used. Actual harvesting losses (timber left in stumps, etc.) are relatively insignificant.

52.43 : 01.7. SANT RAM, B. [Statistical research—miscellaneous, including amendments to the statistical code.] Paper (I). Miscellaneous notes on sample plot work. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 9 (c), 1941 (245-7).*

52.43 : 01.7. SANT RAM, B. [Statistical research—miscellaneous, including amendments to the statistical code.] Paper (II). The measurement of standing sample trees. With appendix by [M. V.] Laurie. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 9 (c), 1941 (247-51, 251-3).*

The report of the Committee on this subject presents a long list of amendments to the standard statistical code, the revised edition of which should be consulted.

In the first paper sample-plot work is discussed with reference to soil investigations, recording of surface vegetation, numbering of trees, selection of sample trees, calculation of results, and grading of produce

MENSURATION. INCREMENT. YIELD

into assortments. The second paper gives an account of various methods that have been tested for the measurement of standing sample trees.

52.43.3 : 52.3 : 12.26-8. ZIMMERLE, H. Untersuchungs-
ergebnisse bei der Schwarzerle. [Results of investiga-
tions on Black Alder.] *Allg. Forst- u. Jagdztg.* 118, 1942
(297-308). [G.] [Forstliches Versuchswesen Württem-
bergs.]

A report on investigations made in Württemberg, partly on permanent sample plots. From the data obtained a volume table and taper tables were prepared for local use.

52.46. Strip Surveys. Enumerations. Timber Cruising

52.46 : 22.14 : 01.7. LAURIE, M. V. [Statistical re-
search in irregular crops.] With appendix by B. Sant
Ram, 'Suggested standard instructions for the layout of
lines and collection of data in irregular forest', and
summary of debate. *Proc. 5th silvic. Conf. Dehra Dun,*
1939, Item No. 9 (b), 1941 (227-35, 235-38, 239).

M. V. Laurie's paper deals with the technique of
laying out and maintaining linear and tree-increment
plots, and the method of analysing results. The
contribution by B. Sant Ram adds standard instructions
for the layout of lines and collection of data in irregular
forest, which will be included in the revised statistical
code. It was agreed that periodic enumerations pro-
vide the simplest and most promising method of obtain-
ing data, but that they are not sufficiently reliable and
need supplementary data from demarcated plots. The
linear plots provide growth and mortality data for
single trees but must be supplemented by compact
plots for the study of optimum total growing stock and
diameter distribution.

56. INCREMENT

56 : 12.26-8 : 52.3 : 52.43.3 : 64 : 22.82-3. ZIMMERLE,
H. Beiträge zur Biologie der Esche in Württemberg.
[Contributions to the biology of Ash in Württemberg.]
Allg. Forst- u. Jagdztg. 118, 1942 (246-55, 273-83,
308-18). [G.]

Data obtained from sample-plot investigations of
pure stands of high quality were used in the preparation
of a volume table and taper tables for *Fraxinus excel-*
sior.

The height growth in pure first-quality stands of the
older age classes was much greater than that for all
other broadleaved species in Württemberg as well as for
comparable Ash stands in Hesse, and far ahead of that
of second-quality stands. Investigations of mixed
Beech/Ash stands (generally single-stem mixtures in
which other broadleaved species were present) of
different quality and age classes, on relatively dry sites,
showed that the Ash tends to be suppressed and that
the regulation of such mixtures is unduly difficult and
expensive; group mixtures are more favourable under
such conditions.

56.01 : 12.25 : 24.1 : 21.3 : 65.7. PARKER, H. A. Effect
of site and density on Lodgepole Pine seedling growth.
Silvic. Leaflet. Dom. For. Serv. No. 20, 1944. p. [1].
[Kananaskis Forest Exp. Sta.]

From a study of two very dense stands of 7-year-old
seedlings of Lodgepole Pine (*Pinus contorta*) on (1) a
rich, moist clay loam and (2) a dry clay-loam bench,
it appears that: (a) regeneration of this species is prolific

on exposed mineral soils; (b) site (2) is more favourable
for germination and early survival than site (1), while
height growth of established seedlings was more than
twice as fast on site (1) as on site (2); (c) cleaning
greatly stimulated height growth on both sites, light
cleaning appearing to be more favourable on site (1)
and heavy cleaning on site (2).

56.02 : 12.25. GINDEL, J. Aleppo Pine as a medium for
tree-ring analysis. *Tree-ring Bull.* 11, 1944 (6-8).
[Agricultural Research Station, Rehovet, Palestine.]

After a brief review of ring-formation in Aleppo Pine
(*Pinus halepensis*) as influenced by climatic factors, the
author concludes: 'Although Aleppo Pine shows early
and great sensitivity to climatic elements, particularly
to rains and temperature, discrepancies appear between
the relative ring-width and the amount of annual
(winter) rainfall. These discrepancies are due to un-
favourable distribution of rains, too high or too low
temperature, and the intensity of khamsin winds
during the seasonal growth. The dynamics of these
climatic factors form also conditions favourable for the
formation of false rings which are sometimes inner but
more frequently outer rings'.

56.02 : 12.25 (74.6). LUTZ, H. J. Swamp-grown
Eastern White Pine and Hemlock in Connecticut as
dendrochronological material. *Tree-ring Bull.* 10, 1944
(26-8). [Yale Univ., New Haven, Conn.]

A surprising similarity was observed in growth
fluctuations of White Pine (*Pinus strobus*) and Hemlock
(*Tsuga canadensis*) grown in a Connecticut swamp and
the same species grown in upland situations in Massa-
chusetts and New Hampshire. Attempts to correlate
the growth fluctuations of the swamp-grown trees with
climatic conditions such as temperature or precipitation
were unavailing. It seems, therefore, that other factors,
or factor complexes, besides precipitation and tempera-
ture, may influence tree growth in diverse habitats. If
this is so, swamp-grown trees may also have dendro-
chronological value.

56.02 : 12.25 : 11.14 : 11.62.3. MOINAT, A. D. Annual
growth of Pines in the San Juan Basin, Colorado, as
related to precipitation and stream-flow. *Tree-ring Bull.*
10, 1944 (29-30). [Colorado State College Branch,
Hesperus, Colorado.]

Records of annual ring widths of *Pinus ponderosa*
growing in the San Juan Basin of southwestern Colorado
were compared with the October-June precipitation and
the streamflow records at Durango. Although it is
impossible to deduce details of climate from tree-ring
study, the data obtained from these investigations
indicate that the climate of the San Juan Basin has not
differed materially during the last four or five hundred
years from that of the period covered by weather
records.

56.02 : 12.25. SCHULMAN, E. Notes on dendrochro-
nologies at the Arnold Arboretum. *Tree-ring Bull.* 10, 1944
(30-2).

Some general observations on tree-ring characteris-
tics of the species *Cedrus libani*, *Juniperus virginiana* and
Tsuga canadensis.

56.02 (481 : 485) : 11.21. SCHULMAN, E. Tree-ring
work in Scandinavia. *Tree-ring Bull.* 11, 1944 (1-6).

These notes are intended to make available some of
the data recorded in recent papers by Erlandsson
(Sweden, 1936) and Ording (Norway, 1941) [cf. *For.*

MENSURATION. INCREMENT. YIELD

Abstr. 5 (144). The author presents a chronology map based on the tables of these authors, and briefly discusses variations in chronology, the correlation of tree rings with climate, and the problem of archaeological dating. It is suggested that the climatic significance of fluctuations in the 15,000 year varve (annual clay layer) series in Sweden would be better understood if it became possible to cross-date them with tree rings.

56.02 (496) : 11.21. DEMIRTAS, E. **Dendrochronological investigations on Pine in Central Anatolia.** *Ziraat Dergisi* 4, 1939 (30-3). [Turk.]

An account is given of the methods used and results obtained in a dendrochronological study of 76 Pines (*Pinus* sp.) distributed over an area of 40,000 sq. km. mainly in the steppe region of Central Anatolia. The purpose of the investigation was to obtain a record of climatic (particularly rainfall) periodicity as indicated by the growth rings of the trees, which were studied from increment borings. Certain factors that have to be taken into account in making such a study, i.e. the relative density of spring and summer wood and the effect of stand opening and pruning on growth, are noted, and it is shown that in Central Anatolia tree growth is dependent on winter and spring rainfall, summer rainfall being of little importance.

56.04 : 12.25 : 38.62. LEVIN, V. I. Prirost elovyykh drevostoev na osushennyykh ploshchadnykh severa. [The increment of Spruce stands on drained areas of the North.] *Lesnoe Khozyaystvo* No. 11, 1940 (14-24). [Russ.]

Investigations by the Archangel Forestry Institute in a stand drained 25 years earlier showed that trees of all age classes up to 200 years had responded to the drainage by a considerable increase in current volume increment.

57. DEVELOPMENT AND STRUCTURE OF STANDS. YIELD

57 : 12.25 (47.6) : 22.89. TIMOFEEV, V. P. Produktivnost' khvoynnykh porod v lesnoy opytnoy dache sel'skokhozyaystvennoy akademii im. K. Timiryazeva. [The yield of conifers in the experiment forest of the Timiryazev Agricultural Academy.] *Lesnoe Khozyaystvo* No. 12, 1940 (21-30). [Russ.]

Data on the comparative development of Pine, Spruce, Pine-Spruce, Siberian Larch, and European Larch plantations established on similar sites in the experimental forest (near Moscow) approximately 60 years ago and left untouched except for the removal of dead and suppressed trees. The Larch grew much faster than the other species, and European Larch proved to be faster-growing than Siberian Larch. At

the age of 61 years the stem diameters and volumes of growing stock per ha. were as follows:—

	Average diameter	Growing stock per ha.
	cm.	cu. m.
Pine	22.4	382
Spruce	20.6	327
Pine-Spruce	19.1	434
Siberian Larch	22.0	542
European Larch	28.6	537

57 : 22.82-3. WIEDEMANN. Der Vergleich der Massenleistung des Mischbestandes mit dem Reinbestand. [Comparison of the yield of mixed stands with that of pure stands.] *Allg. Forst- u. Jagdztg.* 119, 1943 (123-32). [G.]

A general discussion of the principles of research on this subject. One complicating factor in comparing the yield of mixed stands with corresponding yield tables for pure stands is that the height growth (the indicator of site quality) of a species grown in mixed and pure stands is not necessarily the same for the same site. This is due to the competition of the different species in the mixed stand and to the effect of thinnings that regulate the mixture.

57.9 (54) : 01.7. LAURIE, M. V. [Statistical research—yield tables.] Paper (I). Note on the policy with regard to yield tables and future sample plot work. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 9 (a), 1941 (209-12).*

57.9. SANT RAM, B. [Statistical research—yield tables.] Paper (II). Compilation of yield tables. *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 9 (a), 1941 (212-22).*

57.9 : 65.6. SANT RAM, B. [Statistical research—yield tables.] Paper (III). Application of yield tables to abnormally stocked crops and approach of the latter to normality. With summary of debate on Item 9 (a). *Proc. 5th silvic. Conf. Dehra Dun, 1939, Item No. 9 (a), 1941 (223-6, 226).*

The titles indicate the contents of the papers which include proposals to exclude sample plots that have outlived their utility and to fill gaps in the yield table data. It was agreed to compile multiple yield tables for different thinning treatments, and money yield tables, and to collect data of out-turn of timber assortments. The validity of Gehhardt's formula for the increment of understocked crops is to be tested for important Indian species. These projects involve an amendment of the standard statistical code.

6. MANAGEMENT. WORKING PLANS. SURVEYS

60. GENERAL LAND MANAGEMENT

60.3. Management of Different Classes of Forest

60.3 (74) : 4 : 90. Recommended forest practice standards for New England. [Silvicultural Committee, Society of American Foresters.] [1943?] pp. 11.

Recommended minimum standards of forest management and protection; the recommendations are made for New England generally, and separately for each major forest region.

60.31 : 12.26-8 (485). De ädla lövträden. [The cultivated species of deciduous trees.] *Skogen* 31, 1944 (293-4). [Sw.]

A plea is made for more intensive exploitation of the valuable deciduous trees in Sweden.

60.31 (75.8) : 21 : 12.25-8 : 4 : 23 : 24. PATTERSON, A. E., and WEDDELL, D. J. Management of Georgia's woodlands. *Bull. G. F. Peabody Sch. For., Georgia No. 1, 1943, pp. 34.*

Notes are given on natural regeneration, protection

against fire, insects and diseases, grazing, afforestation, thinnings and fellings, and the marketing of timber.

60.31.2 (410) : 97.2 : 61.31. STEVEN, H. M. Private forestry—the next steps. *Scot. For. J.* 58, 1944 (33–52).

The post-war policy proposals of the Forestry Commission are noted. Suggestions are made for the benefit of woodland owners on the compilation of a minimum factual record of the condition of their woods; such a record is essential for an intelligent decision on 'dedication' and the most suitable type of State assistance. The role of woods in estate economy and the contribution which private owners can make to British forestry are also discussed.

60.31.2 (481) : 07.6. ERDE, E. Om anlegg av demonstrasjonsfelter i skogbygdene. [Establishment of demonstration plots in forest districts.] *Tidsskr. Skogbr.* 3–4, 1944 (56–61). [Nor.] N.D.A.

60.31.2 (481) : 07.6. KIERULF, T. Om anlegg av demonstrasjonsfelter. [Establishment of demonstration plots.] *Tidsskr. Skogbr.* 3–4, 1944 (61–3). [Nor.] N.D.A.

Propaganda for sound forestry practices is of considerable importance as a means of improving the management of private woodlands (about 80 per cent. of the forest area) in Norway. These woodlands are under public control through the Forest Conservation Act of 1932, but in many cases their management is still far from satisfactory. Although the inspecting forest officer has the power to enforce certain prescribed practices, the area under the control of each officer is so large that most of the work must be left to the owners.

In 1937 Det norske Skogsekskap (The Norwegian Forestry Society) proposed the establishment of plots in each parish of forestry importance in order to demonstrate silvicultural technique. These two papers discuss the main points to be considered in planning and establishing demonstration plots. F. F.

60.31.2 : 12.25–8 (78 : 79) : 24.3 : 72 : 12.19.2. REYNOLDS, R. R., BOND, W. E., and KIRKLAND, B. P. Financial aspects of selective cutting in the management of second-growth Pine-hardwood forests west of Mississippi River. *Tech. Bull. U.S. Dep. Agric.* No. 861, 1944. pp. 118.

Natural second-growth Shortleaf Pine/Loblolly Pine/hardwood stands west of the Mississippi River are characteristically uneven-aged. The management studies described in the bulletin led to a number of conclusions, some of which are given below.

The existing stands are generally understocked and contain many trees of little or no value. Owners must raise both the quality and the volume of the growing stock before they can obtain substantially higher returns. A system of light cuttings on a short cycle is the best means of improving the growing stock while still obtaining income from the property. This need not necessarily increase exploitation costs. The cost per unit volume of felling and bucking sawlogs is approximately the same whether the cut per acre is 500 or 5,000 bd. ft., and the cost of extraction and haulage is only very little greater if use is made of trucks with dual-wheel trailers, which, in dry weather, can be driven to any point in the woods. The availability of this equipment also greatly facilitates exploitation in connexion with salvage. Logging and milling costs per unit volume decrease as tree size increases. The stumpage realization value (difference between sale

value of lumber and costs of production excluding stumpage, profit, and uninsured risk) was found to be usually negative for trees under 13 in. diameter and positive for larger trees, but owing to variation in timber quality this limit is not sharply defined. Because of the present good market for pulpwood, tree tops and also entire trees that are unprofitable for use as saw timber and which it is not desired to retain in the stand can often be used profitably for pulpwood. Owners of seriously understocked stands can choose between (1) removing the whole of the increment or even more, or (2) removing less than the increment and building up the growing stock. Under the first procedure present returns are low because of the cutting of many small trees, while future returns may be even less, whereas under the second procedure the net returns can be gradually increased. Besides yielding sufficient income to cover taxes and timber-growing and logging costs, stands containing 2,000 bd. ft. or more of saw timber per acre can be gradually built up to a volume of at least 10,000 bd. ft., after which they should yield at least \$5 per acre annually. The great area of Pine/hardwood forest west of the Mississippi presents a vast opportunity for enterprising management. *From authors' conclusions.*

65. DESCRIPTION OF GROWING STOCK

65 : 12.25 (43.8) : 56.2. HEGER, A. Aufbau und Leistung von naturnahen Wäldern im Osten und ihre forstwirtschaftliche Behandlung. [Composition and yield of hitherto virtually unmanaged forests in the east and their silvicultural treatment.] *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 5, 1943 (166–89). [G.]

Observations and notes, chiefly on more or less even-aged Spruce stands in western Galicia at about 1,300 m. elevation. The stands showed a high current increment (4.2–6 cu. m. stem wood per ha., corresponding to an increment per cent. of 0.94–1.30). There did not appear to be any clear relationship (for the individual trees) between increment per cent. on the one hand and diameter, crown development, height, or age on the other. The early growth of the trees had been comparatively fast; sample analyses showed that the average width of the annual rings in the first twenty years was 1.2–5 mm., while a height of 4 m. was reached at the age of 16–50 years.

65.6–7 : 21.11. GEVORKIANTZ, S. R. Measuring stand normality. *J. For.* 42, 1944 (503–7). [Lake States Forest Exp. Sta., St. Paul, Minn.]

A composite relationship which reflects the structural pattern of normal stand development and is an indirect measure of species tolerance was developed by the author. This is expressed as follows:

$$C = \frac{(AH)^b}{AD} \quad (1)$$

where A = age of stand

H = average total height, in feet, of all trees in the stand.

D = average stand diameter (corresponding to the average basal area of the stand), in inches.

C and b are constants varying with species and tolerance.

In logarithmic form, the equation (1) represents a straight line:

$$\log (AD) = b \log (AH) - a$$

where $C = a$ which is the point of intersection on the y axis.

b is the slope of the straight line.

The slope constant (b) and the intersection constant (a) were found to vary with species, apparently in order of their tolerance, and with degree of crowding in the stand.

The practical applications of this relationship are discussed briefly.

66. POSSIBILITY. SUSTAINED YIELD. YIELD REGULATION

66: 12.25: 24.32. PEARSON, G. A. Cutting cycles in Ponderosa Pine. *J. For.* 42, 1944 (575-85). [South-western Forest and Range Exp. Sta., Tucson, Ariz.]

The data presented in this article are based on 30-year records of five management areas, in the Fort Valley Experimental Forest, Arizona, ranging in size from 112 to 456 acres. Three intensities of cutting left residual stands per acre ranging from 1,873 to 4,510 bd. ft. and from 3.9 to 13.7 trees 12 in. d.b.h. and over.

On all five areas the rate of net increment increased

during the first 10 years after cutting, thereafter decreasing until in the last ten-year period (20-30 years) it was about 50 per cent. below that attained in the first decade. More than half the net volume increment during the last decade was contributed by trees that had entered the 12-inch class since the beginning of the record. Factors contributing to the decline in growth include mortality, the large number of slowly dying trees (those in advanced stages of mistletoe infection, those defoliated by squirrels, and those struck by lightning but not killed), and stagnation due to local overstocking.

The remedy for this condition lies in frequent cuttings, aiming most directly at salvage but also, as a more far-reaching objective, at keeping the stand in growing condition through control of competition and other inhibiting influences. *From author's summary.*

67. PERIODIC AND ANNUAL WORKING PLANS

67: 60.31.2. BAYNE, A. An outline of a working plan for the woods of a small privately owned estate managed principally for timber production. *Scot. For. J.* 58, 1944 (66-72).

7. FOREST ECONOMICS, VALUATION, AND FINANCE

71. FUNDAMENTAL ECONOMIC PRINCIPLES

71: 60.31. DIETERICH, V. Les buts des recherches et de l'enseignement de l'économie de l'exploitation forestière (Forstliche Betriebswirtschaftslehre). [The aims of research on, and teaching of, the economics of forest management (Forstliche Betriebswirtschaftslehre).] *Inter-sylva* 2, 1942 (38-59). [F.f.g.e.span.ital.]

'Forstliche Betriebswirtschaftslehre' is concerned primarily with the study of the economic peculiarities of individual forest enterprises [cf. *For. Abstr.* 1 (205)].

74. VALUE OF THE STAND. VALUE OF THE FOREST 74.2 (76.8): 98.3: 12.25: 12.26-8. CAMPBELL, R. A. Selling prices and production costs in the Tennessee Valley. *J. For.* 42, 1944 (647-56). [Tennessee Valley Authority, Norris, Tenn.]

This article presents tree values of local species based on maximum price regulations, and the cost factors usually considered in determining a fair appraisal. The data have been designed to cover conditions normally encountered in the varied topography of the Tennessee valley where a large proportion of the lumber produced is manufactured by portable mills.

76. MANAGEMENT STATISTICS

76.1: 23.24 (410). HILEY, W. E. Planting costs. *Quart. J. For.* 38, 1944 (94-8).

Data supplied for four plantations on the Sprowston Estate near Norwich (costs of clearing, fencing, planting, beating up, and cleaning) suggest that under comparatively favourable conditions, and after deducting the Government grants, present costs of replanting woodlands are about £35 per acre, of which £9 is the cost of fencing and £8 the cost of maintenance and cleaning for the first 10 years. Similar data from the woods of Dartington Hall Trustees, South Devon, indicate somewhat lower costs.

76.2: 12.25: 23.24.3: 97.2 (75.9). Young Pines answer need for greater diversification in southern crops, offer profitable return from marginal agricultural acres. *Sth. Pulp Paper J.* 7 (3), 1944 (17).

Average returns from two plantations of Slash Pine (*Pinus caribaea*) in northern Florida are given at more than \$3.00 per acre. Of the planting espacements tested (8-, 10-, 12-, and 16-ft.) that at 8 x 8 ft. gave the highest yield.

8. ADMINISTRATION

8. ADMINISTRATION

81. ORGANIZATION. REGULATION OF SERVICE

81 (73). The status of civil service in State forestry. Report of Committee on Civil Service, Society of American Foresters. *J. For.* 42, 1944 (560-3).

82. LABOUR QUESTIONS

82. HASS, M. Unfallverhütung im Forstwirtschaftsbetrieb. [The prevention of accidents in forestry.] *Forstarchiv* 19, 1943 (233-38). [G.]

The author lists and briefly discusses the various

causes of accidents due to (a) factors connected with the place of work, (b) the nature of the work itself, and (c) personal factors, and suggests means by which specific types of accident may be avoided. Some suggestions are added on the prevention or control of accidents in general.

82: 32.2. NAUMANN, B. Unfälle im Forstbetrieb. [Accidents in forestry.] *Forstarchiv* 19, 1943 (239-44). [G.]

Statistics of the Forest Service of Saxony for 1935-38. The increased rate of forest exploitation has led to more accidents, the annual rate of accidents being such that

ADMINISTRATION

one man out of every six engaged in forest exploitation suffered an accident. Preventive measures are discussed.

82 : 38.2. GEETE, E. Flyttbar raststuga för skogsarbetare. [Portable rest hut for forest workers.] *Skogen* 31, 1944 (51-2). [Sw.]

The hut is of simple construction, can be easily moved and quickly erected. It is large enough for 3 or 4 men to rest in (122 cm. × 183 cm. × 183 cm.). The walls and roof are of specially treated wallboard on a

framework of posts that can easily be dismantled. The total weight is about 145 kg., and no part is too heavy for two men to carry.

82 (410). DALGLEISH, T. W. Recruitment, wages and conditions of forestry workers in relation to post-war forestry. *Scot. For. J.* 58, 1944 (64-6).

Improved facilities for education, good wages and housing, and provision for superannuation are considered to be among the essential conditions for building up a good forestry personnel.

9. FOREST POLICY

9 (410). Memorandum by the Council of the Institution on the report on post-war forest policy, and the supplementary report on private woodlands by H.M. Forestry Commissioners. The Chartered Surveyors' Institution, 12, Great George St., Westminster, London, S.W.1. 1944. pp. 4.

9 (410) : 94.3. Observations by the Land Agents' Society on the proposals contained in H.M. Forestry Commissioners' report on post-war forest policy and on the supplementary report by H.M. Forestry Commissioners. Private Woodlands. *J. Land Agents' Soc.* 43, 1944 (153-4).

9 (54.3) : 91 : 97.3 : 34.21. MAITLAND, V. K. Some requirements of post-war forest policy in the C.P. With appendix. *Indian For.* 70, 1944 (327-39 + plates).

The writer advocates the setting up of a Forest Policy Committee in the Central Provinces to discuss the resolutions on provincial forest policy formulated by the Post-war Reconstruction Policy Committee (No. 5) at Simla in June, 1944, and to determine the permanent forest policy of the Central Provinces. The importance of forestry lies not only in the vast extent of forest or potential forest land in the Central Provinces (40,000 square miles out of a total of 98,559 square miles) but also in the fact that these forests occur in a watershed area which includes the headwaters of five great river systems.

In 1894, when the ultimate owner of the state forest was the Government of India, a forest policy was defined by the Government in *Forest Code*, 7th edition, appendix 5. The only serious defect in this policy in its application to the Central Provinces was its laxity in the provision of grazing facilities in minor forests. Since the introduction of provincial autonomy the Government of the Central Provinces has been responsible for its own forests, and it is now necessary to decide either on the formulation of a new forest policy or on the acceptance of the old Government of India policy with minor modifications, particularly in respect of (1) the grazing problems in minor forests, (2) the relative importance of revenue production, and (3) the adaptation of land use in conformity with changes which have taken place since 1894 or which may be expected to take place in the near future.

The extension of state control in forestry is considered most desirable as a means of preserving the fertility of the soil, which is the main economic asset of the people. Soil erosion (due to the steady destruction of private forests and to the high incidence of overgrazing) and desiccation have already become problems in the Central Provinces. It has not always been

recognized that the poorer type of forest, on which heavy grazing is permitted, may have great functional value in the control of erosion. The writer recommends a flat grazing incidence in all forests, which will allow even the poorer pastures to recover and maintain their productivity. He deprecates the granting to cultivators of grazing rights which are withheld from professional graziers and suggests that restriction of grazing may be brought about by adjustments of the grazing rates. Higher rates would tend to reduce the amount of grazing (with a consequent improvement in forest conditions) and a selective influence would be exerted on quality of the stock which are retained.

Stress is laid on the need for higher wage rates for forest officials, and the view that revenue production is a criterion of efficiency is strongly criticized. Real development may only be expected when the benefits derived by communities living near forests are directly associated with the prosperity of these forests.

Detailed forest policy is also required with respect to the control of private forests and the creation of fuel reserves.

A copy of the resolutions passed by the Policy Committee at Simla on matters related to forestry is appended.

9 (71) : 91.8 : 98.2. CANADA. The Canadian Forestry Situation, 1944. Reports and papers presented to the thirty-sixth annual meeting of the Canadian Society of Forest Engineers. Canadian Society of Forest Engineers, 10, Manor Road West, Toronto, Ontario. 1944. pp. 72.

At the thirty-sixth annual meeting of the Canadian Society of Forest Engineers, held in January, 1944, a series of papers and reports was presented by the Dominion Forester and representatives of the provincial forest departments and forest industries, in which plans for post-war reconstruction in forestry and the use of the forests in a national programme of post-war reconstruction and rehabilitation are discussed. These reports are believed to give the best composite picture of the present conditions and future needs of Canadian forestry that has yet been prepared.

The plans for post-war developments discussed by the various authorities are concerned mainly with (1) improvement in forest conditions and practices, and (2) the provision of work projects that can most usefully be incorporated in a scheme to provide employment on a large scale and be of greatest benefit to forestry. Proposed work projects of primary importance in all regions are: (1) the improvement of forest-protection facilities and (2) the construction of roads for the

FOREST POLICY

transportation of forest products. In addition, there are a number of other projects of fairly wide application, either as new undertakings or extensions of the post-war programmes, e.g. forest surveys, reforestation, and development of recreation facilities. Important problems are also suggested in connexion with the production of waste in logging operations and timber manufacture, forest education and training, and silvicultural work. The cost of the proposed programme and the man-hours of work provided are given in some detail. [See also *For. Chron.* 20 (1), 1944.]

(71). KENNEDY, H. Canada's post war forestry programme. *B.C. Lumberm.* 28 (8), 1944 (29-30, 40, 42).

In this conference paper the author discusses Government policy with regard to the forest resources and forestry in Canada, damage caused by fire and insects, forest management, farm forestry, forest industries, and the importance of forestry in post-war rehabilitation.

(71.1) : 66. Ten-point sustained yield policy advocated in forest engineer's brief. *B.C. Lumberm.* 28 (7), 1944 (25-6, 36, 38); (8), (46, 48, 50, 92, 94, 96).

In a brief prepared by the Vancouver and Victoria Sections of the Canadian Society of Forest Engineers presented before the Sloan Commission on Forestry, ten principles are set forth as the basis for a policy of sustained-yield forestry for British Columbia. Regulation rather than restriction of cut is advocated as the means of establishing sustained-yield management. Sections of the brief deal with: silviculture, logging methods and reforestation; protection from fire; protection from insects and fungi; nature and effect of capital and investment; depletion, regulation of cut and sustained yield; land classification, tenure and taxation; forest research; forest education; and general notes on administration. [See also *For. Chron.* 20, 1944 (171-87).]

(73) : 98.2-3. HERBERT, P. A. A foreign forest policy for the nation. *J. For.* 42, 1944 (631-6). [Michigan State College, East Lansing, Mich.]

The author outlines three general types of foreign forest policy that could be adopted by the United States, and discusses in detail the five principles of a policy that, it is suggested, will meet the standard of maximum benefit to the people of the U.S. These principles are stated briefly as follows:—

1. Forest products may be imported into the United States only when the raw material has been grown in forests under sustained-yield management.
2. Such forest products may be imported without the payment of duty.
3. They must be free of harmful diseases and insects.
4. Research activities will be undertaken (a) to determine all possible uses of foreign forest products by United States consumers, and (b) to increase the production of such products that are of use to U.S. consumers.
5. When forest research definitely indicates that the value of a foreign forest product to the United States justifies special inducements to increase its production and availability, such inducements should be authorized for the period, and to the amount, considered necessary.

90. GENERAL PRINCIPLES OF FOREST POLICY

(83) : 07.1-2. CANNONBIO, A. Hacia un código forestal. [Towards a forest code.] *Simiente* 13 (3), 1943 (17-8). [Span.] *Biol. Abstr.* 18 (14529).

The establishment of a National Forestry Council for Chile is announced. A programme including the economic, educational and scientific aspects of forestry and conservation is suggested.

90 (945) : 98.1 : 60.3 : 23.24. GALBRAITH, A. V. Summary of evidence presented before the Rural Reconstruction Commission of the Ministry of Post-war Reconstruction. *Misc. Publ. For. Comm. Victoria* No. 2, 1943. pp. 71.

Evidence on the various aspects of forestry and the use of forest products in Victoria is presented in the form of replies to a questionnaire.

91. SOCIAL AND ECONOMIC SIGNIFICANCE OF THE FOREST

91 (67.6) : 98.1 : 60.3. GRAHAM, R. M. The role of the forest. *E. Afr. agric. J.* 10, 1944 (28-33). [Forest Department, Kenya.]

The author stresses the importance of co-ordinated planning of all activities connected with the allocation and utilization of land, to the social conditions of a country such as Kenya, and the importance of water conservation and an adequate supply of cheap and serviceable sawn timber.

It seems probable that there will be a progressively greater demand for timber by the native population of the country as the standard of living gradually improves. To meet these estimated future requirements it will be necessary to start planting on a large scale now. In answer to a suggestion that the Forest Department may not be justified in growing large stocks of timber which may not, in the end, be saleable, the author presents the following arguments: (1) It is impossible to compute accurately the amount of timber which will be wanted in fifty years' time, but a surplus is preferable to a deficit. (2) Where large quantities of cheap timber are available, consumption may be expected to increase. (3) The rate of felling can be adjusted to meet the demand. (4) Any surplus production would be available for export. It is suggested that exports might profitably take the form of manufactured or semi-manufactured goods.

91 (71.4). La forêt dans l'économie de la Province de Québec. [The forest in the economy of the Province of Quebec.] Association Forestière Québécoise, Inc., 2, Côte d'Abraham, Québec. 1944. pp. 275. [F.]

Papers by several authors on the role of the forest in the economy of different parts of Quebec.

91 (73) : 94 : 96 : 98.1 : 60.3. Forest-resource conservation and development in the post-war period. U.S. Department of Agriculture. Interbureau Coordinating Committee on Post-war Planning, Washington, D.C. 1942. pp. 48 + map + tpls.

The purpose of this statement is to provide those engaged in post-war planning with background information on the relation of the forest land resource to the regional and national economies. It is also intended to present some of the Department's proposals regarding the future use of forest lands and the measures, including capital improvements, that are needed to bring about such use. The statement deals *inter alia* with the influence of ownership on forest land use; the timber resources and timber requirements of the U.S.A.; the need for public forest regulation, forest acquisition, and various types of public assistance to private enterprise; proposals for intensification of

FOREST POLICY

management of the national forests and of federal research in forestry; and suggested public-works activities in connexion with the conservation and development of forest land in different types of ownership.

91.1. *Rural Preservation. Reserves. National Parks*

91.1 (410) : 97.1-3. RHYS, J. P. *Forestry and country planning.* *Quart. J. For.* 38, 1944 (88-92).

Notes and comments on the Town and Country Planning (Interim Development) Act, 1943, and 'The Town and Country Planning Additional Regulations', dated August 14, 1943. The new act has made it possible for local authorities in Great Britain to safeguard individual trees, groups of trees, or woodlands at once and without waiting for a formal development scheme to come into operation in their area.

91.1 (410) : 97.1. *Nature conservation and nature reserves.* Report of the Committee appointed by Council on 26 May, 1942. Approved by Council, October, 1943. *J. Ecol.* 32, 1944 (45-82).

The Committee was set up by the British Ecological Society to consider the question of nature conservation in Britain, with particular reference to plant and animal communities and species.

The only method of preserving wild vegetation with its population of lower animals, and so of maintaining the beauty and interest of characteristic British scenery, is by setting aside certain areas as nature reserves. The present tendency to replace much of the natural and semi-natural woodlands of Oak, Beech, Ash, Alder and Birch by economically managed forests and plantations is discussed at some length. Since the primary object of the British Forestry Commission is to produce timber to meet economic requirements, it is inevitable that it should plan the formation of extensive plantations of exotic conifers, with the result that many kinds of native flora and fauna may disappear and be replaced by species better adapted to the new coniferous woodland. However, the conifer plantations are to be established mainly on poor land unsuitable for agriculture where these species appear to thrive better than do most deciduous trees, and, provided a substantial amount of native deciduous woodland is maintained on suitable sites, the proposed planting of 3,000,000 acres of open ground with conifers might result in a welcome variety of vegetation. However, it is still doubtful to what extent pure coniferous woodland can be maintained in this country since certain soils show progressive deterioration with the accumulation of coniferous humus. It may be found that mixed plantations of conifers and deciduous trees have an important place in future British forestry.

Apart from commercial plantations it is desirable that there should be conserved as large an area as possible of the surviving deciduous woodland, representing the widest possible variety of sites and forest types, as well as the remnants of native Pine and Birch woods in the Scottish Highlands.

In order to meet scientific needs, the establishment of small natural reserves in addition to National Parks and 'Scheduled Areas' is recommended.

91.3. *Influence of the Forest on the Environment*

91.3 : 11.14.3. MARTIN, O. M. *Influence of forest on rainfall.* *Indian For.* 70, 1944 (325-7).

A brief review of the general principles underlying the effect of forests on rainfall and on subsoil water.

91.4. *Value of the Forest in Hygiene and Recreation*

91.4 (73). WAGAR, J. V. K. *The forester's place in the field of recreation.* *J. For.* 42, 1944 (496-500). [Colorado State College, Fort Collins, Colo.]

This paper discusses the scope of outdoor recreation in the United States, the various professional and vocational groups interested in the subject, and in particular those aspects of outdoor recreation connected with forest conditions and use.

91.5. *Value of the Forest for Colonization*

91.5 (71.4) : 94.4. LAROCHELLE, A. *Colonisation agricole forestière.* [Agricultural forest colonization.] *For. québec.* 7, 1944 (347-54). [F.]

The author discusses, with special reference to part of Quebec Province, the advantages of, and conditions for, the type of colonization in which settlers derive part of their livelihood from forestry work. Co-operative settlements are advocated.

92. FOREST LAW

92 (73) : 66. GRANGER, C. M. *The cooperative sustained yield act.* *J. For.* 42, 1944 (558-9). [U.S. Forest Service, Washington, D.C.]

A summary of the main provisions of the bill, generally known as the Cooperative Sustained Yield Act, which was passed by the U.S. Congress on March 29, 1944. The act gives the Secretary of the Interior or Agriculture the authority '(1) to establish cooperative sustained yield units, (2) to enter into cooperative agreements which are in effect coordinated management plans for public and private timber, (3) to establish sustained yield units composed entirely of federal lands, (4) to enter into cooperative agreements with other federal, state, or local public agencies, (5) to sell timber at appraised value without competitive bidding within cooperative units where a cooperative agreement is in effect and within federal sustained yield units'.

92 (73). UNITED STATES. *Some forest regulatory legislation as enacted or introduced by various individual States.* U.S. Forest Service, Washington, D.C. 1943. pp. 51.

92 (73). UNITED STATES. *Some forest regulatory legislation as enacted or introduced by various individual States.* [Additional information.] U.S. Forest Service, Washington, D.C. 1943. pp. 35.

92 (79.5) : 43 : 32 : 94 : 95. ROGERS, N. S. *Objectives and accomplishments of the Oregon forest laws.* *J. For.* 42, 1944 (480-2).

Aspects of the Oregon forest laws dealing with fire protection, regulation of commercial timber cutting, forest land ownership and taxation, and timber utilization, are discussed briefly.

94. FOREST OWNERSHIP

94.12 (71.4). *Forêts de communauté.* [Community forests.] *Publ. Ass. Ing. for. Québec* No. 30, 1941. pp. 22. [F.]

A general discussion based on data from Europe and the United States. In Canada community forests are found in Simcoe County and other parts of Ontario. Possibilities for establishing such forests are discussed with special reference to Quebec.

FOREST POLICY

96. POLICY REGARDING PROTECTION FOREST AND AFFORESTATION

6 (54.5) : 91.3 : 11.62.2 : 60.32. PRING, N. G. A note on catchment afforestation in N.W. India. *Indian For.* 0, 1944 (247-52).

The importance of woodland for maintaining subterranean water supplies and in erosion control is discussed. The maintenance of forests in northwest India is made difficult by (1) extensive grazing, (2) logging of broadleaved species for fodder, and (3) indiscriminate felling without restocking.

If a scheme for the provision of separate village plantations for timber and for fuel or fodder can be incorporated into the anti-erosion planning, the problem of afforestation in hill districts will be simplified. It is urged that large-scale afforestation should be begun immediately in order to prevent further loss of soil fertility through erosion and further reduction of the subterranean water supply. Piecemeal afforestation, however advantageous locally, is apt to aggravate conditions elsewhere, and complete success can be expected only if there is co-operation between foresters, engineers, agriculturists and others in all the provinces and states in the catchment area.

6.3 : 12.26-8 (485) : 98.1. GEETE, E. Vårt ekbestand måste bevaras. [Sweden's Oak stands must be preserved.] *Skogen* 31, 1944 (187-9). [Sw.]

There is a great demand in Sweden for Oak for parquet flooring and furniture, and, with the high prices being paid for the timber, Oak stands are rapidly disappearing.

A 'Society for promoting the cultivation of Oak' has been formed with the object of preparing an inventory of Oak stands and of selecting elite trees which will yield crops of best quality for afforestation. R. P. J.

97. POLICY REGARDING THE RELATION OF THE FOREST TO AGRICULTURE, PASTURE, AND INDUSTRY

7.1 (71.1) : 91.8. MULHOLLAND, F. D. Land utilization and settlement after the war. *For. Chron.* 20, 1944 (61-6). [Department of Lands, Victoria, B.C.]

A general discussion with special reference to British Columbia. Land utilization surveys are necessary as a basis for the establishment of communities in which settlers would derive their livelihood from agriculture, farm-woodland management, and outside work in industry.

7.1 (79.4). WEEKS, D., WIESLANDER, A. E., JOSEPHSON, H. R., and HILL, C. L. Land utilization in the northern Sierra Nevada. University of California, Berkeley, California. 1943. pp. vii + 127.

7.1 (79.4) : 09.4. WEEKS, D., WIESLANDER, A. E., JOSEPHSON, H. R., and HILL, C. L. Land utilization statistics for the northern Sierra Nevada. *For. Surv. Release Calif. For. Range Exp. Sta.* No. 3, 1942. pp. 56 + map.

The first publication gives the results of a survey conducted by the California Agricultural Experiment Station and the California Forest and Range Experiment Station. The second publication is a statistical supplement to the first and gives in tabular form many of the data accumulated in the survey.

7.3 (77.1) : 23.13 : 45.11. DAMBACH, C. A. A ten-year ecological study of adjoining grazed and ungrazed

woodlands in northeastern Ohio. *Ecol. Monogr.* 14, 1944 (255-70). [Ohio State Univ.]

The development of flora and fauna and the economic possibilities on a formerly severely grazed Sugar Maple (*Acer saccharum*) woodland were studied during the ten-year period immediately following discontinuance of grazing and compared with conditions on an adjacent grazed woodland of similar composition.

While no tree regeneration became established on the grazed area, seedlings, mainly of Sugar Maple, appeared in large numbers in the ungrazed woodland during the third growing season subsequent to its protection; these attained an average abundance of nearly 80,000 per acre by the middle of the eighth growing season. A notable improvement in the accumulation and distribution of leaf litter took place in the ungrazed area.

Annual censuses of breeding birds over a five-year period indicated that they were four times more abundant and of twice as many species on the ungrazed as on the grazed woodland. Mammal populations showed a somewhat similar correlation. Over-wintering invertebrates were found to be $2\frac{1}{2}$ times more abundant in leaf litter from ungrazed area than in that from the grazed tract.

98. THE TIMBER MARKET

98.1 (43.8 : 47.4-6) : 81. BARTH, J. Die Forst- und Holzwirtschaft in den besetzten Ostgebieten. [Forest and timber economy in the occupied eastern regions.] *Forstarchiv* 19, 1943 (30-6). [G.]

This article includes notes on the organization and work (chiefly the supply of timber for the army) of the German forestry and timber authorities in the occupied eastern regions.

98.1 (481) : 09.4. Norges skogbruk under okkupasjonen. [Forestry in Norway during the occupation.] *Skogsägaren* 19, 1943 (163-7). [Nor.]

Soon after the occupation of Norway the Germans took over complete control of forest exploitation. During the three-year period 1941-43 the total annual cut for all wood products averaged about 22 million cu. m. or 220 per cent. of the annual increment. The best-grown and most favourably situated forests have been particularly heavily cut.

A large amount of forest nursery stock is being grown in Sweden for use in Norwegian forests after the war. R. P. J.

98.1 (485) : 09.4. Riksskogstaxeringen av Gävleborgs län. Virkesförrådet—ca 98 Kbm pr ha—oförändrat. [State forest survey of the Province of Gävleborg. The supply of timber—about 98 cu. m. per ha.—unchanged.] *Skogen* 30, 1943 (183-4). [Sw.]

The results of the survey carried out in the summer of 1942 show that the supply of timber from trees 10 cm. d.b.h. and larger in the Province has not changed appreciably in amount during the 16 years since the previous survey. The difference is a reduction of only 0.8 per cent. R. P. J.

98.1 (54.2) : 33.06. HOPKINS, G. M. Fuel supplies in the United Provinces. *Indian For.* 70, 1944 (253-6).

A brief history of firewood and charcoal demands and supplies in the United Provinces, with an explanation of the present situation and the methods adopted to deal with it.

FOREST POLICY

98.1 (68) : 12.25 : 09.4. KING, N. L. Review of the position in regard to supplies of softwood in State plantations. *J. S. Afr. For. Ass.* No. 11, 1944 (6-13).

Detailed figures of the acreages of the several coniferous species in each Conservancy of the Union of South Africa are available to 31 March, 1941. On that date the total area was 267,856 acres. The potential annual sustained yield is estimated at 32 million cu. ft. of saw timber; however, this yield can only be realized at the end of the rotation when regular clear fellings commence. It is estimated that the annual yield of softwood sawlogs from State plantations for the period 1942-43 to 1952-53 will rise from about 12½ million to over 18 million cu. ft. From a review of the supply position in the various regions of the Union it appears that in the whole of the Cape Province the present rates of supply to sawmills cannot be maintained and that the activities of the mills concerned will have to be curtailed. The same applies, though to a lesser extent, to Natal and the Orange Free State. Only in the Transvaal is an extension of the sawmilling industry possible in the near future.

98.1 (71.3-6) : 33.02 : 60.31 : 94. KOROLEFF, A. Our future wood supply. Canadian Pulp and Paper Association, Montreal, 1944, pp. 5.

After referring briefly to statistical data on pulpwood supplies in eastern Canada [cf. *For. Abstr.* 4 (11-2)], the author discusses various factors affecting the future wood supply of the region, particularly the present status and possible future development towards increased efficiency and closer integration of the three main departments of commercial forest management—logging, protection and silviculture. Mention is made of the need for improved woodlot management, the value of forestry propaganda, and the problem of forest ownership in the region in question.

98.1-2 (43.7) : 09.1. KOSLIAR, K. Die Produktion und der Absatz des Holzes in der Slowakei vom Gesichtspunkte der Versorgung der europäischen Staaten. [The production and sale of wood in Slovakia from the point of view of the supply of the European States.] *Z. ges. Forstw.* 75 [69], 1943 (163-83). [G.]

This article discusses the history of forestry, present forestry conditions, and timber production and trade in Slovakia.

98.1-2 (72) : 66. Problemas post-bélicos de la industria maderera en América. El porvenir de los bosques en Méjico: [Post-war problems of the timber industry in America. The future of the forests of Mexico.] *Maderil* 16 (188), 1944 (15, 25-7). [Span.]

Extracts from a recent report of the Mexican Federal

Commission for Economic Planning. It is believed that the world timber demand will be unusually high in the immediate post-war years, and that this will afford the Latin-American countries, including Mexico, an excellent opportunity for developing their export trade. Mexico could make available for export considerable quantities of timber. In order that the country may derive the highest possible benefits, forest exploitation should be undertaken to a large extent by the owners themselves, especially in the case of communal and collectively-owned forests, and should be carried out in an orderly fashion compatible with the principles of sustained yield. Essential conditions for progress are a good system of forestry credit, thorough studies on the available timber resources, sound forest legislation, leadership by the forestry authorities, and widespread forestry education.

98.1-2 (73). The lumber situation in the United States. *B.C. Lumberm.* 28 (6), 1944 (67).

In 1943 the American lumber industry recorded a decline in both production and consumption as compared with 1942, and further restrictions were imposed on the consumption of lumber for non-essential uses. There was a heavy withdrawal of lumber from stocks, and it is expected that, with the occupation of more territory by Allied Forces, the demand will increase in 1944 and a further extension of lumber controls is likely to take place.

98.2 (71.1). MANNING, F. A. E. The lumber industry of British Columbia: past, present, and future. *B.C. Lumberm.* 28 (5), 1944 (34, 38, 40).

98.2 (73) : 33.1-3. SWEET, C. V. Small forest industry, *J. For.* 42, 1944 (509-12). [Forest Products Laboratory, Madison, Wis.]

This paper discusses the need for an intermediate group of forest industries in the United States to complete the chain of utilization and fabrication, and for the adaptation of new developments in wood technology to such industries.

98.3 (485) : 09.4. Sveriges trävaruproduktion minskad med 1/3 under krigsåren. [Sweden's production of wooden goods diminished by one-third during the war years.] *Skogen* 31, 1944 (135). [Sw.]

In 1943 Sweden's timber exports totalled only 200,000 standards compared with 380,000 in 1942 and 490,000 in 1941. The 1943 figures included approximately 10,000 std. of dressed lumber and 10,000 std. of boards compared with 20,000 and 9,000 std. respectively in 1942.

R. P. J.

NOTES FROM THE DAILY AND THE NON-TECHNICAL PRESS

References: 1. *Foreign Commerce Weekly*, Washington. 2. *Kölnische Zeitung*, Cologne. 3. *Mercurio*, Santiago and Valparaíso. 4. *Timber Trades Journal*, London. The numbers in brackets indicate the reference number and the date of publication of the newspapers and journals to which the annotations refer.

Brazil. Despite the reduction in supplies of paper pulp from foreign sources, paper manufacturers in Brazil were able to increase their output by more than 170 per cent. during the 5-year period 1938-43 (1; 26.8.44). Most of this increase was made possible by the successful utilization of native raw materials such as Pine wood, fibrous plants of various kinds, cotton linters, and rice straw. It is understood that a new enterprise at Manaus is considering the manufacture of pulp and paper from the residue of jute. A number of new pulp and paper concerns have been established and others are being planned. A large part of the equipment for the new plants is being manufactured in the country. The pulp and newsprint mill, which was started three years ago at Tibagy in the State of Paraná, is still under construction; when completed, it will be the largest mill of its kind in South America. It is reported that construction has now reached an advanced stage, and even if actual operations are delayed until after the war, owing to the difficulty of obtaining some of the machinery, the mill will nevertheless be in a position to commence operations in the immediate post-war period. Plans are being made for an annual production of 100,000 tons of newsprint, 40,000 tons of chemical wood pulp, and 45,000 tons of mechanical pulp from the wood of native Paraná Pine (*Araucaria angustifolia*); these amounts should meet a large part of the country's requirements.

According to Brazilian press reports there has been a considerable increase in the use of fuelwood, particularly in the industrial region of São Paulo (1; 19.8.44). The monthly consumption in this State now amounts to approximately 1 million cu. m.; it is estimated that 400,000 cu. m. are used by the industries in the city of São Paulo alone. Owing to the unusual demand, rail traffic in fuelwood has exceeded that in coffee and cotton.

Canada. A forest research station of 30 acres, to be designated the Southern Forest Research Station, has been established by the Ontario Government near Richmond Hill, Vaughan Township (4; 7.10.44). The work of the station will include the testing and developing of forest fire-fighting equipment, and pathological and soil studies. Investigations will be made on strains of White Pine (*Pinus strobus*) resistant to the blister rust disease, on fungi attacking nursery stock in general, and on forest sanitation. Soil studies will include the classification of forest soils and the relationship between soils and forest types.

Chile. A number of forest nurseries have been established by the State Forest Department in the last three years (3; 14.6.44). At present these produce over 10 million plants annually. Encouragement is being given to private afforestation by the supply of planting stock at less than cost price and by reductions in taxation on planted land. Between April 2, 1942, and June 2, 1944, over 29 million trees were planted by private owners, the afforested area being 12,619 ha.

The general conclusions arrived at by the American forestry mission, which studied the forest resources of Chile during 1943-44, are as follows (3; 7.5.44):—Forest constitutes 22 per cent. of the total, and 45 per cent. of the productive, land area. Commercial timber lands (*bosques maderables*) amount to about 5½ million ha. Great destruction is caused by fire, the volume of timber thus destroyed being estimated at 4½ times that utilized in millings. The timber industry employs over 40,000 persons and its production is valued at \$300 million. With proper methods these figures could be doubled and the volume of timber exploited could be increased 2½ times. Improved fire protection and utilization methods, and the extension of public ownership of forest, are advocated.

According to regulations issued by the Chilean Government, a newly-created National Forestry Council is charged with the development of a national forest policy (1; 26.8.44). A forestry code and a general policy plan are to be submitted by the Council for official consideration.

Denmark. Fellings in Danish forest in 1942-43 were 67 per cent. in excess of the normal cut, the over-cutting being heaviest in the Beech forests (1; 19.8.44). In the past three years, fellings in these forests have been at a rate corresponding to 2½ times the increment.

Germany. The annual cut in Greater Germany (Grossdeutsches Reich) for the forestry year 1945 has been fixed at 90 million solid cu. m., an increase of 10 million cu. m. over the preceding year (2; 6.9.44). This is almost twice the 1934 cut in the Altreich, which amounted to 47.8 million cu. m. It is intended to extract 40 per cent. of the timber between October 1, 1944, and January 31, 1945, a further 40 per cent. up to April 30, 1945, and the remaining 20 per cent. during the summer.

NOTES FROM THE DAILY AND THE NON-TECHNICAL PRESS

Sweden. The decrease in wood-pulp exports continued throughout 1943, and total shipments dropped to a new low record of 434,000 metric tons, which is less than 20 per cent. of the 1939 export figure of 2,331,000 tons (1; 26.8.44). Mechanical pulp was most affected, exports in 1943 amounting to only 8,000 tons, or 2.5 per cent. of the pre-war quantity. Although production was reduced, a surplus of 415,000 tons of pulp was on hand at the end of 1943; this is 4 times the amount normally held in reserve. The excessive accumulation of stocks was partly due to a great improvement in the fodder situation: sales of cellulose fodder in 1943 amounted to 15,000 tons as against 128,000 in 1942. The export of paper also decreased (189,000 tons in 1943 compared with 602,000 in 1939), although activity in the paper mills was relatively well maintained owing largely to a continued strong domestic demand for paper as a substitute for certain textiles. Paper production in 1943 was about 65 per cent. of the 1939 output.

In 1943, Swedish exports of sawn and planed lumber and of box shooks reached the lowest figure for many years, totalling only 200,000 standards as compared with 355,000 standards in 1942 and 744,000 standards in 1939. The decline in lumber exports during the war years has been severe and continuous. Sales in the domestic market, however, in 1943 amounted to 600,000 standards, or approximately the same as in 1942.